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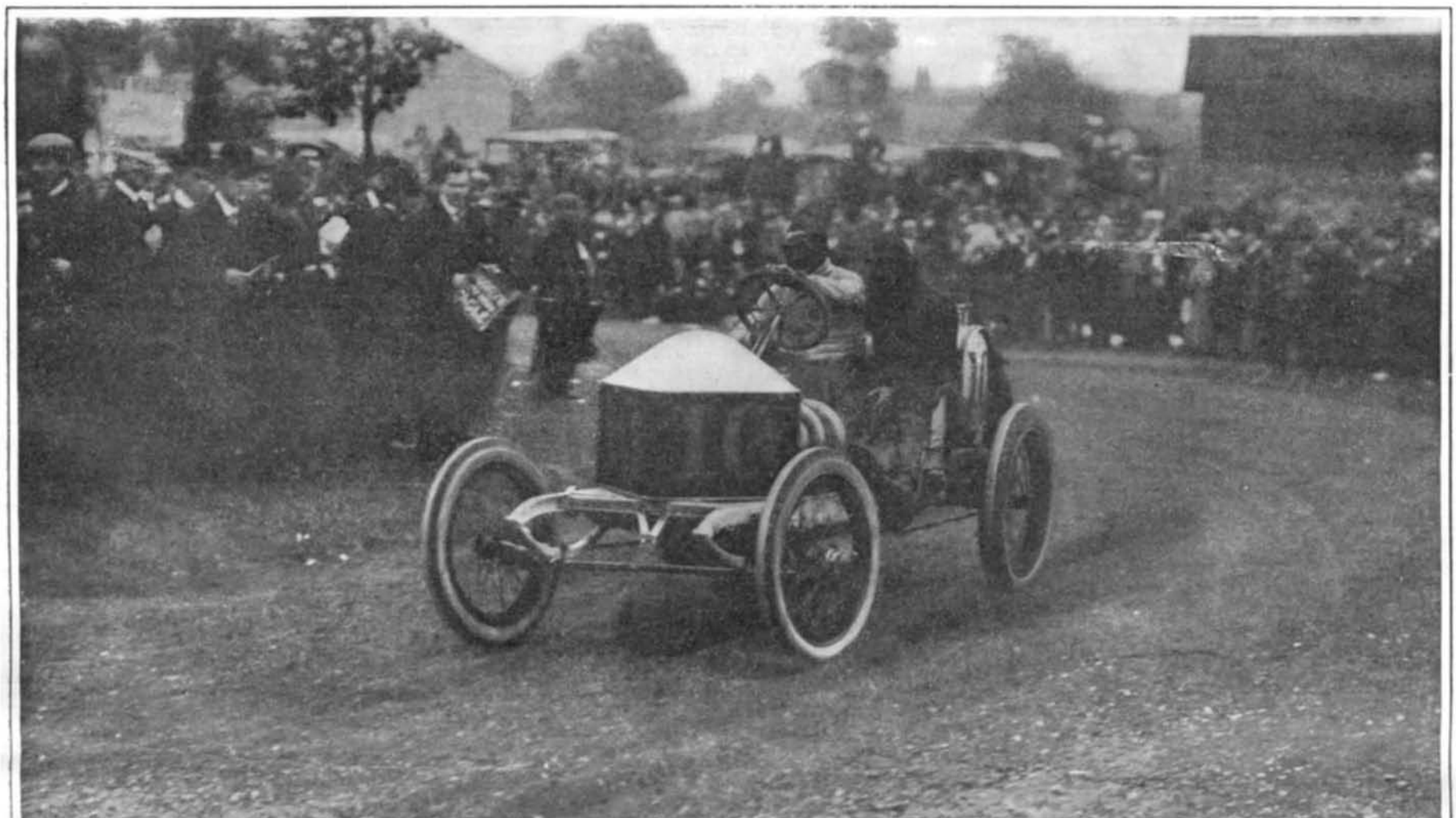
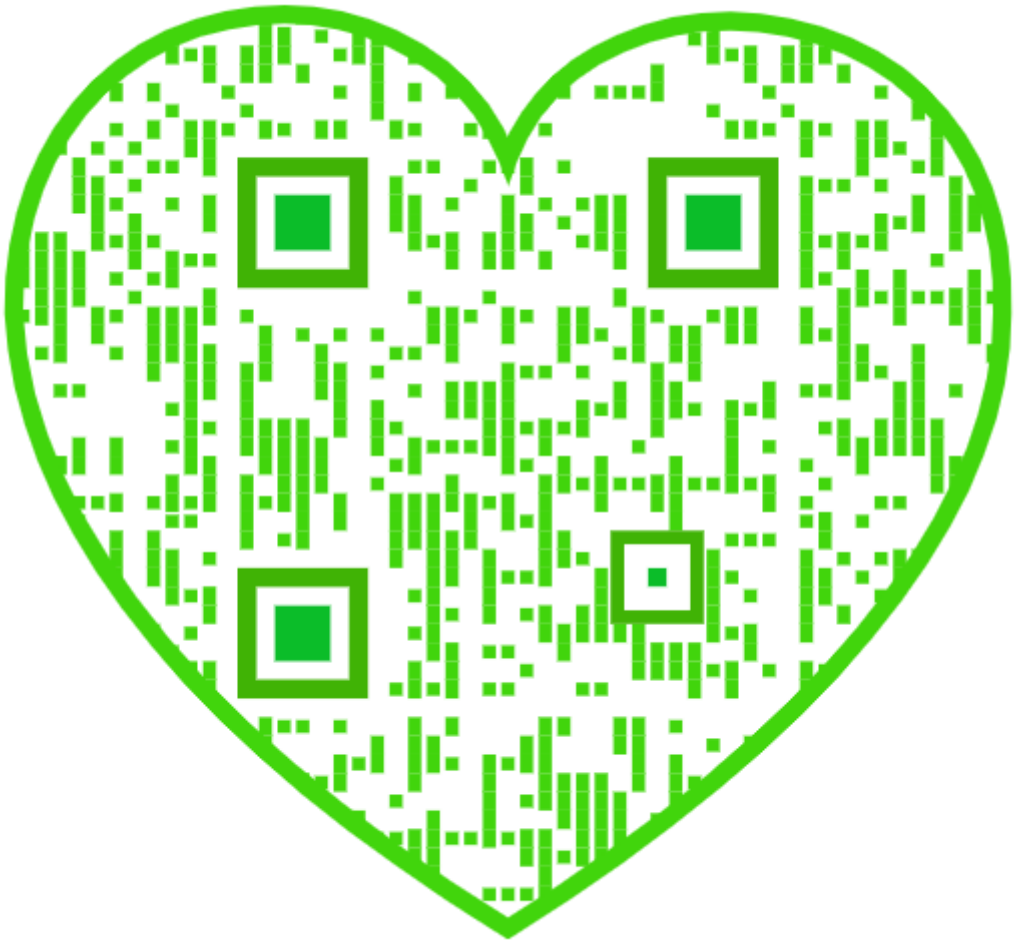


Wagner, on His 100-Horse-Power Darracq, Half Way Around the Hairpin Turn. This Car Won the Race, Covering the 297.1 Miles in 4 Hours, 50 Minutes, 10⅘ Seconds, at an Average Speed of 61.43 Miles an Hour.

Lancia, on His 120-Horse-Power Fiat, Skidding on the Final Bend of the Hairpin. The Italian Car Finished Second in 4 Hours, 53 Minutes, 28⅘ Seconds—an Average Speed of 60.84 Miles an Hour.

THE FRENCH AND ITALIAN CHAMPIONS DISPLAYING THEIR SKILL IN ROUNDING THE FAMOUS "HAIRPIN" TURN IN THE VANDERBILT CUP RACE.--[See page 281.]



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ESTABLISHED 1845

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NEW YORK, SATURDAY, OCTOBER 20, 1906.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

A 21½-KNOT BATTLESHIP.

A battleship which is capable of carrying a battery of ten 45-caliber, 12-inch guns across the high seas at a sustained sea speed of 21½ knots an hour and a maximum speed, for a limited distance, of 22¼ knots, is a proposition which may well be commended to the serious consideration of that diminishing school of naval architects which believes that speed is a greatly overrated quantity in modern warship design. According to press dispatches, the British battleship "Dreadnought," which has been undergoing her official trials, steamed for eight hours over a course 172 miles in length, at an average speed of 21½ knots, during which she reached a speed at times of 22¼ knots. The turbine engines, which were designed for 23,000 horse-power, during the trial drove the ship at a maximum speed for which the corresponding horse-power would be 28,000. These results give to this remarkable ship the distinction of combining in herself, in the highest degree, the characteristics of the battleship and the cruiser; for she has the offensive and defensive qualities of the one and the speed of the other.

In view of the high speed of the "Dreadnought," we think that our naval constructors should depart from the rather conservative policy which they have followed, and allot a larger share of the displacement of our future battleships to motive power. It is true that the "Dreadnought" and the three sister ships which are being constructed are, of all foreign warships, the least likely to be arrayed against our own; but we must remember that since the mark set by this vessel will be the standard of attainment for all foreign governments, we must look for a speed of 20 knots and over in the typical battleships of the future.

Simultaneously with the announcement of the trials of the "Dreadnought," it was stated by a London daily, whose naval information is generally correct, that the designs of the three new British cruisers, "Invincible," "Inflexible," and "Indomitable," which were authorized last year, are based upon the "Dreadnought," and that like her they are to carry a main armament composed exclusively of 12-inch, 45-caliber guns, of which each vessel will carry eight. The three ships are to be of practically the same displacement as the battleship; and by placing the two broadside turrets *en echelon*, or diagonally, at the center of the ship, and the other two turrets on the center line, forward and aft, these cruisers will be able to deliver the same broadside and end-on fire as the "Dreadnought," namely, six 12-inch guns ahead and astern, and eight 12-inch on either broadside. Their contract speed is to be 25 knots an hour; they will be driven by turbine engines; and their armor is to be something between that of the cruiser and the battleship. To all intents and purposes, then, these vessels will be battleships of the first class, carrying armor superior to that of many existing battleships, and having a speed from 6 to 8 knots greater than that of 90 per cent of the ships of this class afloat at the present time. In contemplating these 21½ and 25-knot warships it is disconcerting to remember that we are spending $10,000,000 on two battleships, the "Idaho" and "Mississippi," which are to steam only 17 knots an hour.

In the presence of such facts as these, it is not too much to say that a speed of 17 or even 18 knots is, for all future battleships, obsolete. Hereafter no design should be laid down which contemplates a speed of less than 20 knots an hour.

COMPLETION OF THE PENNSYLVANIA DOUBLE TUNNELS.

At just a quarter past four on the afternoon of October 9, the two shields in the south tunnel of the Pennsylvania Railroad met beneath the Hudson River, and the chief engineer, Mr. Charles M. Jacobs, had the satisfaction of formally declaring that the boring was completed. The driving of the north tunnel was completed over a month earlier, the two shields on that occasion, as on this, meeting with great exactness.

Air pressure was first turned on at the Manhattan end of the north tunnel in June, 1905, and at the New Jersey end of the south tunnel, in the following month. During the intervening period, in which the air pressure has varied according to the depth of the tunnel from 20 to 37 pounds to the square inch, not a single life, according to the statement of the chief engineer, has been lost. During that time the enormous total of 66,000 tons of metal, consisting of the cast-iron lining, has been put in place, and the speed of driving has been such that all previous records on main line subaqueous tunnel work have been broken. Now that the tubes are in place, the important work of sinking the massive tubular piles through the bottom of the cylinders to the rock, which lies far below the silt and sand through which the tubes have been built, will be undertaken. These piles will be driven 15 feet apart along the axis of the tubes, and they are provided with a deep thread which, as the tubes are rotated, will carry them down to rock bottom. Where they pass through the cast-iron shell of the tube they will be rigidly connected to the same, and the weight of the tunnels and the trains that run through them will then be borne directly by the solid underlying rock and hardpan, assisted, of course, by the material through which the tubes have been driven. The strength and security of the tubes will be further insured by lining the interior with a coating of two feet of concrete. Each tube is 23 feet in diameter and over 6,000 feet in length from shaft to shaft. The present estimate of the time necessary to put the tunnels in condition for the operation of trains is about one year and a half.

PANAMA CANAL TO BE BUILT BY CONTRACT.

Next to the purchase of the Panama Canal, the most important step taken by the government affecting this great enterprise is its decision, recently announced, to have the construction of the canal done by contract. In no other way can it be built within a reasonable time. Proof of this has been abundant during the past few months, in which the great paucity of official information regarding the canal has raised a natural fear that matters were proceeding with halting steps, and that the government was encountering difficulties most serious and probably unforeseen. This silence has been in marked contrast to the stream of volubility which flowed from the Bureau of Publicity, or whatever it may have been called, which was instituted when the government first entered seriously upon the work of organization and construction. It is certain that perplexing problems have confronted the advocates of government construction. The Canal Commission appears to have been quite unable to solve the labor problem which, as the weeks have slipped by, has loomed large and perplexing, dwarfing, by comparison, the bugaboos of malaria, yellow jack, or even the turbulent Chagres River itself. For it has proved almost impossible to procure labor of the most simple and unskilled type, white or black, and this in spite of the fact that many experiments have been made with laborers from widely-separated localities, who were supposed to be peculiarly fitted to work under the conditions which prevail at Panama. Moreover, the many efforts made by the Commission to take to the Isthmus and retain there the more intelligent class of men capable of directing the common laborers and of performing other general duties of a more or less authoritative kind, have met with equal failure. It is more than probable that the discouraging results attending the efforts of the government to secure bids for the supply of Chinese labor, have proved to be the last weight in the scales to turn them in favor of doing the work by contract.

Many months ago, when this journal was strongly urging the government to take the step which it has now decided upon, we were taken to task by a technical journal devoted to the engineering and contracting interests of the country, for proposing something which we were assured was, in the very nature of things, an impossibility. It was urged that there were only one or two firms which could command the capital necessary for the undertaking of such a huge task, and that, therefore, competition was out of the question, and the government would be, in the matter of price and time, at the mercy of the contractor. We are willing to admit that if bids were called for upon this work according to the methods commonly followed, there would be much truth in the criticism. But in the plan which the government is about to adopt, the interests both of the country and the contractor are so secured, that we feel satisfied the canal will be built under conditions which will guarantee the interests of both parties to the contract. For although the construction will be let by contract, the government of the United States will not, in the least degree, relinquish its authority over the work. In fact, it will retain under its hand everything save the work of actual construction. The contractor will excavate and build, and the engineers of the government will supervise. The government will make the contract with a single individual or concern, which will be composed of several reputable concerns, each of which will be expert in some particular branch of the work to be done at Panama. The companies presenting bids under the single contracting concern must have an aggregate capitalization, outside of debts and encumbrances, of $5,000,000, and the successful bidder must furnish a bond of $3,000,000.

The bids will be awarded upon what is known as the percentage plan, each bidder setting forth for how small a percentage of profit on the total cost of the work he will undertake to do it. The contract will be awarded to the firm which offers to do the work for the smallest percentage, provided, of course, that the government is satisfied as to its ability to live up to the terms of its bid. The total cost upon which the compensation of the contractor will be based will be estimated by a board of engineers, two of whom will be appointed by the successful bidder, and three by the government. The chief engineer of the Commission will be one of the government's appointees and will act as chairman of the committee.

Before finally adopting the form of contract which is now announced, Chairman Shonts of the Canal Commission consulted with a large number of leading engineers and contractors, and the government is satisfied that several bids will be submitted to the Canal Commission for the work of construction. The competition is not limited to American bidders; and should any foreign firms submit bids to the Commission, they will be considered upon the same basis as those handed in by American firms. In a letter transmitting to Secretary of War Taft the form of contract which the Commission has drawn up, Chairman Shonts states that if the elements of time and cost did not enter so vitally into the undertaking, the Commission would have created its own organization and done the work by day labor. This was rendered impossible by the "unprecedented and greatly-extended industrial activity of the times and the consequent violent competition for all classes of superintendents, foremen, sub-contractors, skilled mechanics, and even ordinary laborers." The great contractors of the United States have organized forces which stand prepared and fully equipped to do such work as awaits them at Panama. The only new conditions which may threaten their efficiency are those due to the climate, with its attendant tropical fevers and general debilitating influences. The government claims, however, to have the problem of sanitation well in hand; and if General Gorgas and his staff of sanitary engineers are given a free hand there should be no cause for apprehension of such epidemics as have been wont to sweep through the Isthmus under the administration of earlier canal builders.

Conspicuous among the advantages of contract construction is the fact that thereby the work will be forever rid of the curse of political patronage. Furthermore, if the contractors are wise they will make it an indisputable condition in the bids that they shall be free to purchase supplies and plants in the cheapest markets, American or foreign.

THE STATUS OF THE LIQUID BARRETTER.

Of the many types of detectors devised for manifesting the presence of impinging electric waves on the aerial of a wireless telegraph receptor, none are more interesting in their various aspects than the liquid barretter of Fessenden.

Different from the coherer, the action of which was discovered by Branly, improved upon by Lodge, and perfected by Marconi, the liquid barretter, or, as it is perhaps better known, the electrolytic detector, is the result of the effort and ingenuity of one man, and to him alone is due the credit for evolving the idea, developing it experimentally, and finally applying it to the commercial reception of wireless telegraph messages.

The first detector Fessenden called a barretter—a euphonious name derived from "barretor," an old French word meaning "exchange," since it possessed the property of exchanging the energy of the oscillations surging through it for a continuous current—was based on the fact that a loop of wire having an exceedingly small diameter requires an infinitesimal amount of current to heat it. To obtain this heating effect by means of electric oscillations set up in the antennæ, the loop was made of a silver wire 0.002 inch in diameter and having a platinum core 0.00006 inch in diameter, the tip of which was immersed in nitric acid and the silver dissolved away, leaving a minute area of the platinum exposed. The ends of the loop were fastened to leading-in wires, which were sealed in a small glass bulb, the completed arrangement appearing very like a miniature incandescent lamp.

The action of this barretter is based upon the following theoretical considerations, namely, that if a wire

having a specific heat factor of such value that the latent energy required to raise its temperature to a certain excess above the air is relatively compared with the energy lost by radiation during the time of a signal, then if such a wire is connected in a local battery circuit, when a given amount of current flows through it there will be a corresponding change in the magnitude of the current produced by the local battery. Thus it will be seen that such a detector is purely thermal in its action.

The hot-wire barretter formed an exceedingly sensitive detector, but it possessed the serious objection of burning out whenever the oscillations surging through it carried any excess of current. This difficulty led Fessenden to conduct a new series of researches, and in one instance a very small column of liquid was substituted for the platinum wire previously used. Many different modifications were tried, and among them may be cited a wire inserted in the liquid, so that the resistance might be concentrated in the neighborhood of the power.

This form finally became the liquid barretter, the subject of much litigation. It consisted of a Wollaston wire having a platinum core of two or three mils, the silver sheath being dissolved away in acid as before, and the exposed point of this was immersed in an acid or alkaline solution; the wire served as one of the terminals of the circuit, a small platinum vessel containing the electrolyte providing the other. This device was patented by Fessenden May 5, 1903.

Its inventor accounted for its action on the theory that the electric waves decrease the resistance of the barretter, since the temperature coefficients of liquids is generally negative, and as the resistance is decreased instead of increased, the efficiency of the detector is further improved.

The great value of the detector was quickly recognized by those versed in the art, and it was not long before there were a half dozen claimants in the field, who used it, insisting that to them belonged the perquisite of discovery and invention. Among these may be mentioned as the most aggressive Vreeland and De Forest in the United States, Schloemilch in Germany, and Ferrie in France.

In November, 1903, Schloemilch published an account of his alleged independent discovery of the liquid barretter principle in the Elecktrotechnische Zeitschrift, and in January, 1904, Vreeland in his book, "Maxwell's Theory and Wireless Telegraphy," puts forth his claim in the following words: "Another electrolytic detector was developed by the writer [Vreeland] in the course of a series of attempts to magnify the heating effects of Fessenden's barretter by immersing the wire in a liquid of high temperature coefficient and low specific heat, which was made a part of the local circuit. The attempt was unsuccessful, but it led to the discovery that a simple electrolytic cell, when polarized to the proper critical point by a current from a local battery, is remarkably sensitive."

De Forest outlined his claims to the liquid barretter in a paper read before the International Electrical Con-ss, St. Louis, 1904, in which he characterized the heat theory of Fessenden as untenable, stating that its operation was electrolytic. Upon this argument De Forest evidently wished to show an analogous action between his own electrolytic responder and the liquid barretter. Ferrie's claim was put forth by Blondel in the Electrical World in a letter published May 6, 1905.

With these various assertions of ownership, it is small wonder that litigation was inevitable, and as a matter of fact no less than six suits have been brought by the opposing interests, five of which were decided in favor of Fessenden, and one against him dismissed.

In the first suit filed by the National Electric Signaling Company (Fessenden) against the De Forest Wireless Telegraph Company et al., in the United States Circuit Court, Judge Wheeler in rendering his decision said the testimony seemed to show that the De Forest detectors operated by bridges formed by the local circuit between closely parallel electrodes broken by the aerial impulse to give the signal, while the liquid barretter does not appear to operate by the making or breaking of any such bridges, but by a fluid path between the electrodes at variable distances.

As to Vreeland's claim, the court held that his work was merely an employee's step in the continuous investigations carried out by Fessenden. The court also disposed of the De Forest contention that the barretter operated electrolytically rather than thermally, holding that th theory of its action was of no importance in the case, and that the device sued infringed the claims of the patent regardless of what its mode of operation might be.

A decision was also rendered on January 27, 1905, in a suit of the National Signaling Company (Fessenden) versus the Gesellschaft für Drahtlose Telegraphie (Schloemilch) and a decree of injunction handed down restraining this company from using the liquid barretter in any of its forms. This disposes of all the active claimants except Ferrie, and after the above decisions it is not probable he will ever attempt to prove priority in this country.

SOMETHING ABOUT CEREAL BREAKFAST FOODS.

There is no part of the world except the Arctic regions where cereals are not extensively cultivated. From the oats and rye of the North to the rice of the hot countries, grains of some kind are staple foods.

An idea of the importance of cereal foods in the diet may be gathered from the following data, gathered by Dr. Charles D. Woods and Prof. Harry Snyder for the Department of Agriculture, based upon the results obtained in dietary studies with a large number of American families. Vegetable foods, including flour, bread, and other cereal products, furnished 55 per cent of the total food, 39 per cent of the protein, 8 per cent of the fat, and 95 per cent of the carbohydrates of the diet. The amounts which cereal foods alone supplied were 22 per cent of the total food, 31 per cent of the protein, 7 per cent of the fat, and 55 per cent of the total carbohydrates—that is, about three-quarters of the vegetable protein, one-half of the carbohydrates, and seven-eighths of the vegetable fat were supplied by the cereals. Oat, rice, and wheat breakfast foods together furnished about 2 per cent of the total food and protein, 1 per cent of the total fat, and 4 per cent of the carbohydrates of the ordinary mixed diet, as shown by the statistics cited. These percentage values are not high in themselves, but it must be remembered that they represent large quantities when we consider the food consumed by a family in a year.

The reasons for such an extensive use of cereal foods are not hard to find. Besides being cheaply and easily grown, the grains contain unusually good proportions of the necessary food ingredients with a very small proportion of refuse. They are also readily prepared for the table and are palatable and digestible. Owing to their dryness they are compact and easily preserved without deterioration.

The grain as it grows on the stalk is surrounded by a hull or husk, which is so indigestible that it is removed before the seed is used for food. Each grain has an outer skin or bran layer, which may or may not be removed in milling. It is nearly always taken off from rice and buckwheat, sometimes from wheat, corn, and rye, and almost never from the other grains unless the outer sections are ground off as in pearled barley. Grains simply hulled or husked and slightly crushed are called groats or grits; more finely crushed they are termed meal, and when ground into a fine powder and sifted they are known as flour.

Grains in the raw state are not usually considered pleasant to the taste and are thought to be difficult of digestion, and therefore cereals are almost always cooked before eating. The simplest and doubtless the oldest way of cooking them was by parching. This was frequently all that was done to the oats which the Scotch Highlanders took as their only provisions in their border forays, or to the corn the American Indians used for a similar purpose. But other ways of cooking make the grain more palatable, and it is usually mixed with water or other liquid and either baked as bread and cakes or boiled or steamed as pudding or porridge. It is the use of cereals as porridge that is of special interest, as cereal breakfast foods are most commonly used in America for porridge making or as a substitute for porridge. When used in this form they are perhaps not as convenient to eat as bread, do not keep so well, and require long cooking, but in spite of these disadvantages porridge is much used the world over, and grains have been thus cooked since earliest times. Many varieties of porridge are found. Sometimes the cereals are simply boiled in water, sometimes with milk, or with meat or kale, as in Scotch brose. Welsh budrum is made from oats which have been allowed to ferment and are then cooked, and the Arabs have a similar dish, kouskous, made from fermented wheat. In the old-fashioned bag puddings of England, of which Christmas plum puddings are the direct descendants, suet and fruit were mixed with wheat or barley and all steamed together in a bag. The simpler kinds of porridge are, however, the most common, and it is from them that modern cereal breakfast foods have been developed.

The number and variety of cereal breakfast foods at present on the market are large, but the majority of them fall readily into one of three groups. The first includes those which are prepared by simply grinding the grain, the second those which have been steamed or otherwise partially cooked and then ground or rolled, and the third those preparations which have been acted upon by malt, which induces a greater or less chemical change in the starch present.

No class of foods is more extensively or ingeniously advertised than the cereal breakfast foods. The claims sometimes made for them are astonishing. Some of them are said to contain several times as much nourishment as the same weight of beef; others are lauded as especially valuable as brain food or nerve tonics, and very many are claimed to be particularly well suited for persons of weak digestion. Many of these claims are obviously preposterous, other are doubtless true, and still others contain an ingenious mixture of fact and fancy. Realizing that accurate information in regard to breakfast foods was needed, investigators at several agricultural experiment stations have recently studied their composition and food value, and it is now possible to make a number of definite and reliable statements about them.

SCIENCE NOTES.

In 1892, Frank Mira, of Jacksonville, Fla., discovered a twig which seemed to him of some use to the perfumer. He submitted it to Mr. E. Moulie of that city, who was engaged in the business of extracting essences. The plant immediately interested Mr. Moulie, who succeeded in producing from it an essential oil. Many attempts on the part of Mr. Moulie and the United States Department of Agriculture to ascertain the scientific name of the plant finally resulted in its identification as *Mentha citrata*, a very rare plant which is popularly called bergamot mint. From year to year Mr. Moulie has increased and developed the few plants which he has been able to obtain, and is now engaged in gratuitously distributing the plant for general propagation. We believe that in this manner a very valuable perfume industry may some day be built up on the cultivation of this rare plant.

A curious result of the frequent and severe seismological phenomena which have disturbed the earth in various parts of the world during the past few months, has been observed in connection with the water wells of Leicestershire, England, from which the inhabitants derive their drinking supplies. Whereas a few months ago the water obtained was sparkling and transparent in purity, during the latter months of the summer it became appreciably deteriorated. Little attention, however, was paid to this peculiarity, which was set down to the long drought and the probability that the wells were becoming exhausted somewhat, until animals refused to partake of it. The water became so highly discolored as to be practically opaque, as if heavily impregnated with yellow clay, while instead of being perfectly odorless it had a distinct smell resembling paraffin. This peculiarity led to the water being tested with a light to determine the possible presence of oil, and immediately it became ignited. Samples were then drawn and permitted to stand for several hours, during which period a thick oleaginous scum rose to the surface, while yellow sediment gathered at the bottom. The oil has been found to be petroleum, the presence of which in the district has never before been detected. A scientist, however, who has investigated the water states that twenty years ago, when the earth was similarly disturbed by earthquakes, a similar effect was produced, and the phenomenon is closely associated with the violent disturbances that have taken place recently in the earth's crust.

Prof. Omori, the eminent Japanese seismologist who has been studying the effects of the Californian earthquake for the past three or four months, has come to the conclusion that California will be free from seismic disturbances for half a century, and probably for a much longer time. He says that in all probability there will never again be so severe an earthquake in California as the one on April 18. The slipping of the crust of the earth was caused by the fact that at the point of weakness it was in unstable equilibrium, resulting from the redistribution of matter. It takes ages to bring this about, and the crust has probably settled to a position in which it will remain for centuries without any slipping. The position of countless tons of matter will have to be changed, and vast quantities of earth to be carried by the rivers into the sea, before there will be so great a redistribution of matter as to cause an earthquake. Prof. Omori says that he is confirmed in this opinion by the occurrence of many minor shocks since the great one, and by the manner of their occurrence. These shocks have been coming at regular intervals and diminishing in force, showing that the crust of the earth is slowly settling to rest in its new position. The minor shocks occur most strongly when the barometric pressure of the atmosphere is greatest. Most of the shocks are so slight that they can be discovered only by the aid of a seismograph, and are of no importance except as helps to an understanding of earthquakes. The professor says that an earthquake of any magnitude is preceded by a series of minor shocks, especially if the observation is made at a location distant from the center of disturbance. Tremors precede the great shocks, frequently by several days. If, therefore, careful observations of these tremors could be made, it might be possible to predict an earthquake. Prof. Omori recommends that bureaus, equipped with seismographs, be established all over the State of California, so that slight tremors may be observed and their effects carefully studied. When a shock occurs, reports would come in from many quarters to the chief observatory, and the center of the disturbance could be located quickly. The Japanese professor will publish a full report of his observations during his visit to California.

THE NEED AND THE TESTING OF PURE DRUGS.

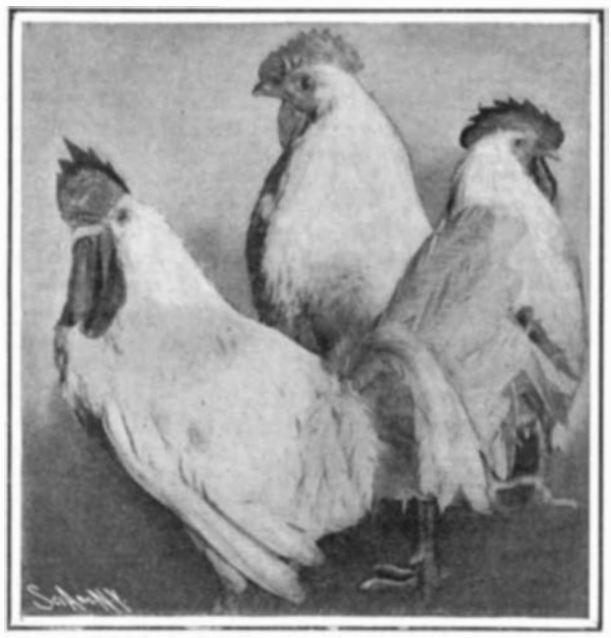
BY HUGO ERICHSEN.

It is, perhaps, not commonly realized that the druggist, by reason of necessity, occupies a position of trust toward the entire community. The helpless, the sick, the physically weak, yea, even the dying, rely upon him absolutely for safety, accuracy, and skill in the preparation of the physician's order. It would be idle to deny that cases have been known in which pharmacists betrayed their trust, but such, happily, were few in number and pertained mostly to the atrocious crime of drug-substitution. This offense is as contemptible, deliberate, and cowardly as a stab in the dark, for in most cases it constitutes a criminal act difficult to prove and against which the victim has no redress whatsoever. Even the atmosphere of the sickroom has been contaminated with the spirit of commercialism and individual greed that seems to have so thoroughly infected our so-called modern civilization. While the integrity of the average pharmacist is all that could be desired, yet he is liable to dispense prescriptions that are not what they purport to be, in consequence of the use of drugs that are either partly or wholly inert. Most druggists have neither the time nor the facilities for making a careful investigation of the physiological action of the many drugs that compose their stock. But that work of late is being done for them, on a large scale, and will eventually revolutionize the drug trade.

Years ago, many manufacturers merely complied with the directions of the United States Pharmacopœia, providing for the selection of the drug by more or less superficial means and its exhaustion by a given menstruum (solvent) to the production of a stated yield. But a leading firm of manufacturing chemists went a step further and attempted to gain some insight into the value of the more powerful drugs by estimating their content of active constituents. Tnis work was attended with much expense and also great difficulty because of the lack of satisfactory methods of procedure. Nevertheless they persevered, and as a result were soon able to arrive at comparative results, which showed to their astonishment that different lots of such drugs as quinine, belladonna, hyoscyamus, nux vomica, and others varied widely in the proportion of the active constituents they contained; that in fact it was the exception rather than the rule to find successive lots of any given drug to be possessed of uniform activity.

The extent to which a drug is contaminated depends, of course, largely upon its commercial value and the ease with which it may be simulated. Drugs like opium and crocus, for instance, are frequently adulterated and fraud is also widely practised in connection with the "manufacture" of powdered chemicals, resinoid or inspissated substances. Although time has wrought an improvement in that respect since cascara sagrada was first introduced to the medical world, that drug is still the object of shameless substitution. Questionable preparations of it are at fault, either because the bark employed in making them is not genuine or has not been properly cured and extracted. Bark less than two years old contains an active ferment that gives rise to unpleasant after-effects and must therefore be considered impure. Other plants are often mixed with strophanthus; there are about thirty varieties of this plant, of which only six contain strophantin, the active principle.

The senna of commerce is frequently adulterated and unsophisticated buyers are sometimes supplied with Tinnevelly senna in place of it, although the latter contains only two-thirds as much of the active principle, i.e., the principle upon which the therapeutic effect of the drug depends. The sennas of Tripoli and Mecca are also of an inferior character. Much of the Chinese rhubarb that is marketed is unfit for use because it is decayed or worm-eaten. Sometimes the cheaper European sorts are powdered, colored yellow with turmeric, and passed off as the genuine article from the flowery kingdom. Asafœtida is contaminated with gum resin of an inferior quality or mixed with foreign substances, such as red clay, barley flour, etc.; in some instances the impurities have been known to reach 30 per cent. Belladonna and white bryonia are sophisticated with the root of a plant designated botanically as *Medicago sativa* and genuine calumba root with what is known as false calumba. Artificial substances are often employed to adulterate Japan camphor.



Effect of the Ergot Test on Cocks' Combs.

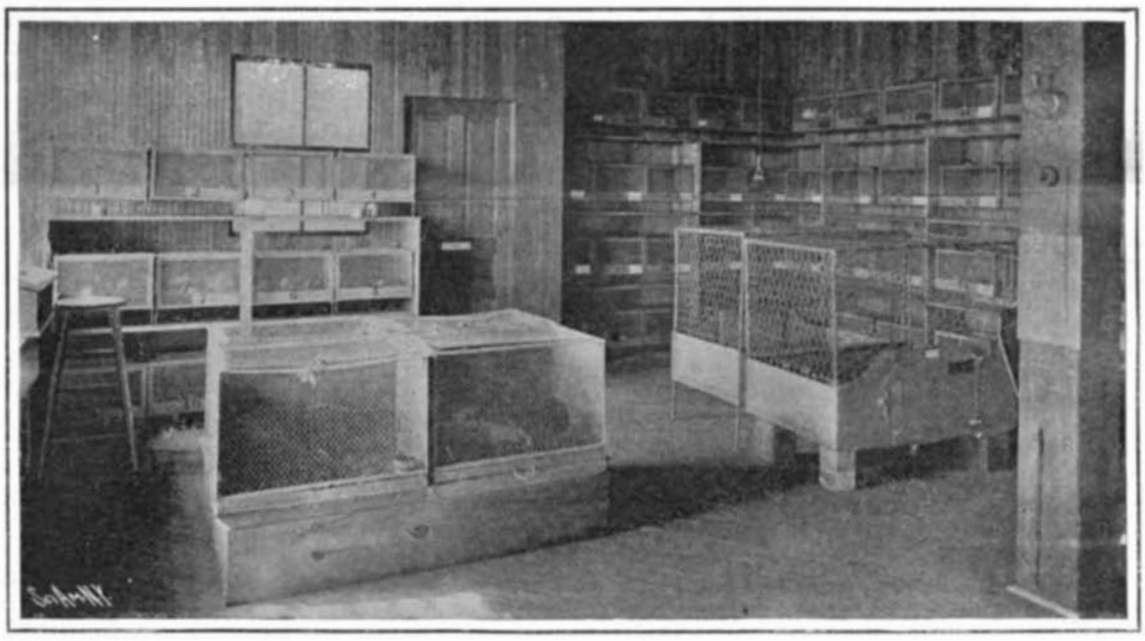
The quality of coca and that of the cinchona bark of commerce varies greatly, which accounts for the fact that the therapeutic effect of some of these drugs is so slight that they may almost be regarded as worthless. Dill and anise are used as the adulterants of conium. False jalaps are not uncommon in the market and sophisticated manna has been described by several authorities. The scammony of Smyrna is frequently displaced by a substitute manufactured in the south of France and the large or false senega of the trade palmed off for the much higher priced true senega. Much of the musk upon the market must be regarded with suspicion, as the high price of the odoriferous article invites imitation. The leaves of *Uva ursi* are often intermixed with the inert leaves of other umbelliferous plants.

The foregoing constitutes a powerful argument why physicians and druggists should avoid questionable medicinal products and give preference to medicaments that are entirely reliable, even though they may be a trifle higher in price. Only the larger laboratories in the country possess the necessary facilities and capital to manufacture a full line of first-class pharmaceuticals. They are imbued with a sense of responsibility and are aware of the fact that their reputation depends upon the nature of the goods they market. Abundant means enable them to engage experts who exercise great care in the selection of crude drugs and reject all materials that do not come up to the standard. Moreover, the gathering of the drug plants is under the direct supervision of men who are thoroughly posted in regard to the pharmacological features of the plant they are looking for. Before the remedy is placed upon the market, it is standardized, that is to say, subjected to tests that determine its therapeutic value and insure uniformity. Having decided upon a standard, the drug is extracted by the proper menstruum, in the most approved manner, assayed chemically, and "standardized" by concentration or dilution as required.

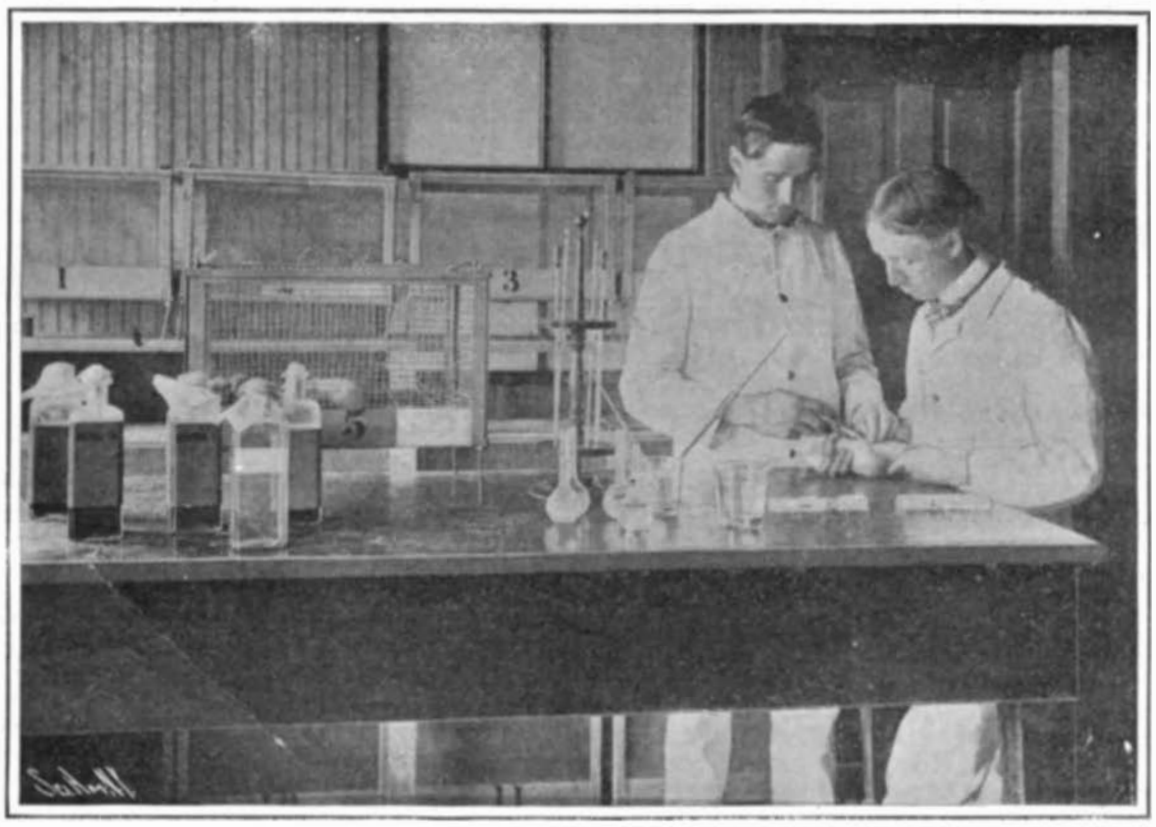
But there are certain powerful drugs, such as the heart tonics, digitalis, strophanthus, and convallaria; the powerful arterial sedative aconite, ergot, cannabis indica, squill, and others equally important that cannot be assayed by chemical processes.

Happily, the method of physiological assay is now available, and practical use is made of the fact that certain of these drugs will produce characteristic physiological effects upon certain animals. For instance, good ergot blackens the comb of the cock, while an inferior specimen fails of effect. The therapeutic value of the heart tonics is measured by means of delicate apparatus which accurately determines the effect of graduated doses upon the cardiac mechanism of frogs. These amphibians are also employed to determine the maximum and minimum dosage of standard preparations of strophanthus.

The medical man is groping in the dark when he prescribes a preparation of unknown strength, the first dose of which may prove ineffective, or possibly poisonous. Under such circumstances he is virtually compelled to make a physiological test upon his patient. Gradually the dose must be increased or diminished until he finds that a definite amount produces the effect desired. But should the prescription be refilled with a



Room in the Laboratory in Which Animals Are Kept While Being Used for Experiment.

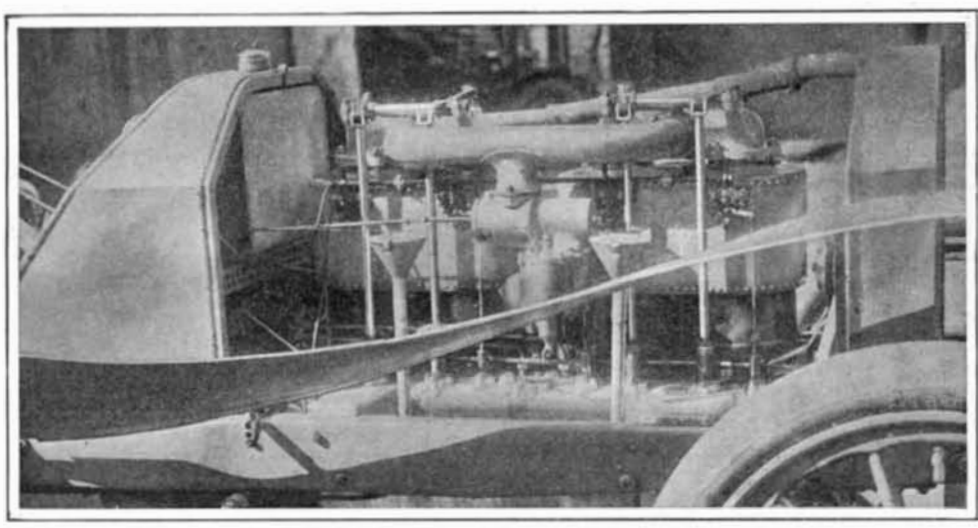


Testing a Remedy on a Guinea-Pig.

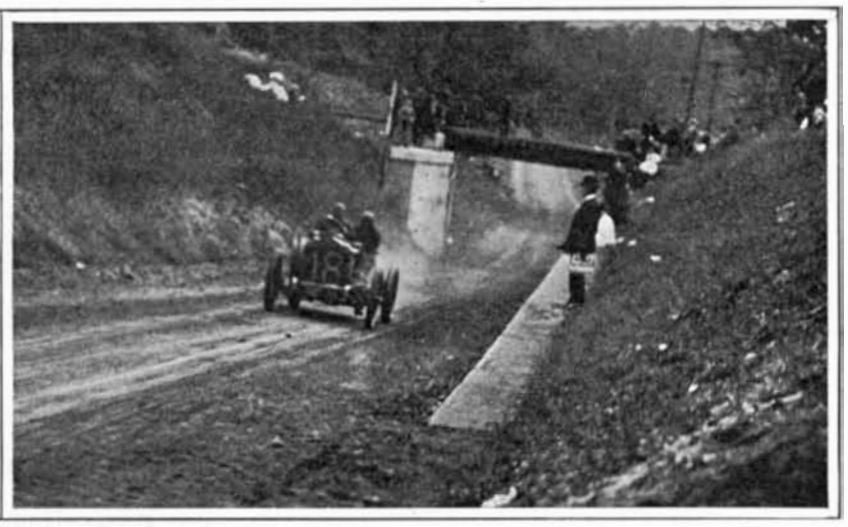
preparation from another manufacturer, or by another apothecary, the correct dose must again be determined experimentally as before. When drugs are standardized by chemical assay or physiological test, however, the physician escapes the humiliation of palpable impotence in the face of danger and there is no occasion for needless experiment at the bedside, where so frequently prompt drug action saves lives.

A RETROSPECT OF THE VANDERBILT CUP RACE.

That the third contest for the Vanderbilt cup was the most successful of the three that have so far been held, is to be credited largely to the great care and good judgment with which the Cup Commission and the officials in charge of the preparation of the course performed their several duties. Special care had been taken to safeguard both the contestants and the multitudes that swarmed out to view the race; and if the onlookers had shown a proper appreciation of the efforts made for their protection, the injuries and accidents which marked the race would have been almost entirely absent. When it is borne in mind that the crowd deliberately tore down the fences which had been put up to keep them off the track, that they swarmed entirely across the road, and refused to draw



Engine of the Locomobile, Showing the Arrangement of the Carbureter, Inlet Valves and Igniters.

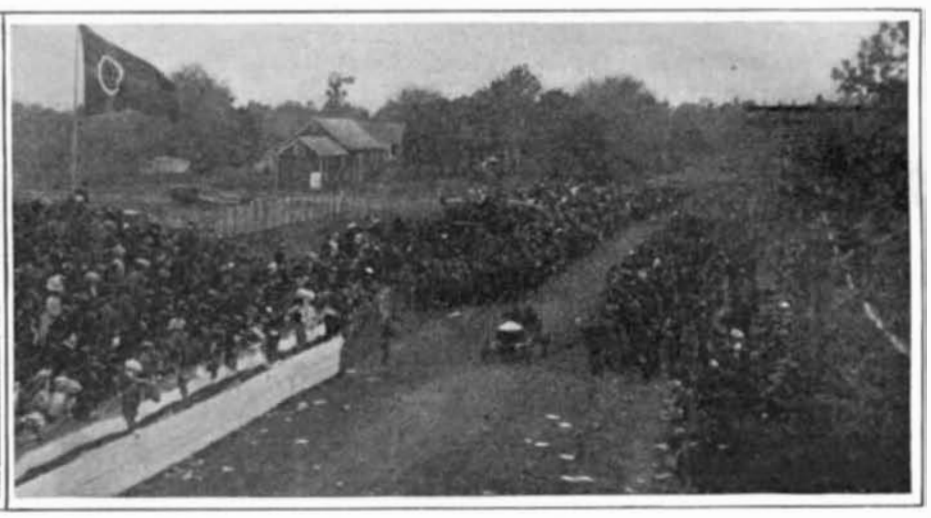


The De Dietrich Racer, Which Finished Third, Ascending a Hill Near Roslyn.

Panoramic View of the Hairpin Turn at Old Westbury, Showing Tracy Starting to Round It in His Locomobile.

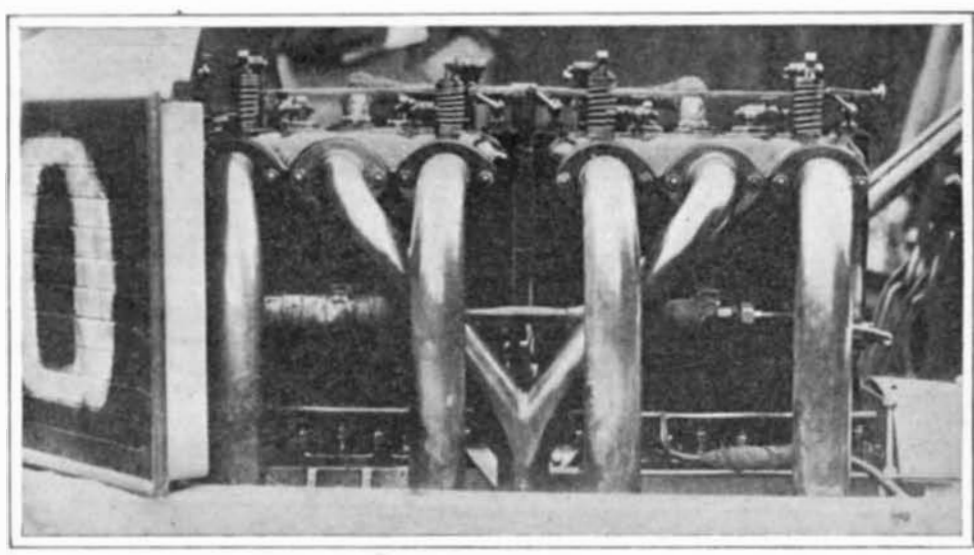
Jenatzy Finishing. The Veteran Belgian Driver Obtained Fifth Place With a German Mercedes Car.

Time, 5 hours, 4 minutes, 38 seconds. Average speed, 58.51 miles per hour.



Wagner, on the Winning Darracq, Passing Through the Crowd at High Speed Just Before He Crossed the Finish Line.

Time, 4 hours, 50 minutes, 10⅘ seconds. Average speed, 61.43 miles per hour.



Valve Side of the 100-Horse-Power Darracq Engine, Showing the Branched Inlet Pipe and the Four Separate Exhaust Pipes. The V-Shaped, Finned-Tube Radiator Is Shown at the Left.

Tracy Putting on Full Power at the Last Bend in the Hairpin. This Machine Made the Fastest Round in 26:21—an Average Speed of 67.65 Miles per Hour.

SOME SCENES AND INCIDENTS IN THE THIRD VANDERBILT CUP RACE.

THE THIRD RACE FOR THE VANDERBILT CUP.

Machine	H.P.	Driver	1st lap	2d lap	3d lap	4th lap	5th lap	6th lap	7th lap	8th lap	9th lap	10th lap
Darracq	100	Wagner	28:26	27:56 2/5	28:17 1/5	27:41 2/5	32:09	27:22	27:41	30:45	27:54	31:58
F. I. A. T.	120	Lancia	30:27	29:34	28:54 3/5	28:17 2/5	28:17	33:02	28:21	28:39	29:06 2/5	28:59 3/5
Lorraine-Dietrich	120	Duray	30:18	28:52 3/5	28:10 1/5	32:57 1/5	28:26 2/5	29:45 3/5	28:04	31:09	28:00	27:52
Bayard-Clement	100	Clement	31:21	33:31	28:44 3/5	28:17 2/5	36:32	29:22	28:10	28:18	29:32	28:11 4/5
Mercedes	120	Jenatzy	30:02	30:16	29:09	28:05	34:34 1/5	28:38 4/5	28:22	28:17	37:44 2/5	29:29 3/5
F. I. A. T.	120	Nazzaro	30:41	35:03 1/5	41:23 4/5	34:21	29:21	28:57	31:49	27:57	27:25 2/5	Still running
Itala	120	Cagno	36:17 3/5	35:20	32:27 2/5	33:13 3/5	38:19 2/5	30:59	32:09	31:44	35:58 4/5	Still running
Thomas	115	LeBlon	57:32 3/5	31:42 2/5	30:47	30:07	30:33	38:38	30:56	30:49	31:21 2/5	Still running
Panhard	120	Heath	39:50	39:22 3/5	34:25 2/5	33:33	33:29	36:34	35:48 3/5	34:07 4/5	Still running	
Locomobile	110	Tracy	38:48	38:53	44:51	31:37	26:21	38:23 2/5	40:26	33:57 3/5	Still running	
Mercedes	120	Luttgen	34:32	32:14	32:14 3/5	30:41 2/5	34:04	50:12	37:36 3/5	33:14 2/5	Still running	
Itala	120	Fabry	41:28	35:21 2/5	36:57 2/5	38:04 3/5	33:49 2/5	37:12 3/5	38:44	Still running		
Christie	50	Christie	34:07 3/5	33:38 2/5	35:15 2/5	45:34	57:40	35:02	37:38	Still running		
Haynes	60	Haynes	45:18	34:35 4/5	34:14 1/5	44:27 3/5	35:58 2/5	47:31	39:23 4/5	Still running		
Hotchkiss	120	Shepard	32:26	31:37 4/5	30:54 1/5	30:23	33:53	30:23 3/5	Killed a spectator and retired.			
Frayer-Miller	110	Lawwell	33:34	1:20:40 4/5	36:11 4/5	39:57 2/5	Retired with broken fan					
F. I. A. T.	120	Weilschott	Broke steering gear									
Mercedes	120	Keene	Did not start, broken cylinder.									

back to the side lines until the cars were almost upon them, it is truly marvelous that the accidents should have been so few. This behavior of the public was unsportsmanlike and extremely unfair. It added greatly to the difficulties of the drivers, most of whom were from foreign countries and therefore, in a sense, our guests. All of the drivers agreed that the speed would have been far greater than it was, if the public had only kept clear of the track and had not, at critical points, obscured the view so badly. The interference was particularly bad at the turns, where, as the winner Wagner stated after the race, it was very difficult to determine just when to slow down and just where to commence to give the necessary degree of "helm" to the steering wheel. Several of the foreign drivers stated that they would never again race under conditions similar to those that obtained on October 6. Hence we are pleased to note that at a recent dinner of the Vanderbilt Cup Commission, it was positively announced that any future race would be held over a private racing course.

Apart from the inexcusable misbehavior of the public, the race of this year was an unqualified success, and although the result proved that the foreign makers still hold a considerable lead over our own, at least in the matter of building purely racing cars, there is satisfaction in the thought that the best car and the best driver won. Although the speed of the winning Darracq car last year (61.49 miles per hour) was slightly greater than the speed (61.43 miles per hour) of the winner this year, the average speed made by the five leaders was much greater than last year. This fact, coupled with the fact that practically all of the cars were running when the race was called, proves that the last twelve months have seen a decided improvement in the art of automobile manufacture. Moreover, everybody who followed the race closely must admit that the failure of the American cars was due chiefly to tire troubles, and not so much to defects in the machines themselves. It was the splendid quality of the tires used by the foreign machines, and the fact that all of them carried detachable rims, which contributed so largely to their better showing. On account of a slight rain which fell just previous to the race, the oiled road was rendered somewhat slippery, and non-skidding tires, with roughened metal treads, were found to be necessary. Although most of the foreign cars started with tires of this kind, the American cars unfortunately did not use them at the start. At the end of the first round Tracy, driving a 110-horse-power Locomobile, had his tires changed for those of the steel-banded non-skid type. When the tire company's supply of this type was exhausted, tires having steel-studded leather bands were substituted. None of the American non-skid tires showed the endurance of the foreign ones, and, as we have stated, it was largely for this reason that the American cars, or at any rate those of the normal type, made no better showing. That the speed was not wanting in at least one of these, is shown by the fact that the fastest round of the race was made by Tracy, who drove his Locomobile over the fifth lap of the course in 26 minutes and 21 seconds, which is equivalent to a speed of 67.65 miles an hour. It is estimated that on account of the many slowdowns at the turns, this machine must have been traveling at over 100 miles an hour on this round on the straight.

The 115-horse-power Thomas car, driven by the Frenchman Le Blon, was leading the American cars and was in eighth position when the race was called off, Le Blon being at that time on the last lap. Next to him of the Americans came the Locomobile, which was running on the ninth lap, being then in tenth position. The next American was the Christie machine, driven by its owner and builder, which was running in the thirteenth position on the eighth lap; and in the fourteenth position and also on the eighth lap was the 60-horse-power American Haynes touring car, which by the way did not make so good a showing as to speed as it did in the elimination race of two weeks before. Except for tire troubles, Christie's little 50-horse-power touring car made such consistent running as to excite the wish that he could have been steering the powerful 100-horse-power racer which was disabled during his training for the elimination trial. The last of the American cars was the Frayer-Miller air-cooled car, which retired on the fifth lap with a broken fan. The experience of the three Frayer-Miller cars, each of 110 horse-power, seems to indicate that although this type is admirably adapted for touring cars, in which it has shown excellent results, it is not quite equal to the severe demands which are made when the horse-power exceeds 100, and the machine has to be pushed for five or six hours to the utmost limit of its capacity.

The performance of the winning Darracq car was highly creditable both to the maker of the machine and to its driver, young Wagner. Considering the crowded condition of the course and the loss of speed due to the use of non-skid tires, the speed of 61.43 miles an hour, at which the race was won, compares favorably with the speed made last year with faster tires and over a course that was less crowded and included fewer turns. The driving of Lancia, who came in second and whose average speed was 60.84 miles an hour, came fully up to the reputation of this great driver, who was the winner in last year's race, in which for 200 miles he averaged 72 miles an hour; and his failure to take the cup was undoubtedly due to the fact that his successful rival was driving a car that was just about an even minute-to-the-lap faster than his own. Duray driving the Lorraine-Dietrich car at an average speed of 60.27 miles an hour was a close third to Lancia, whose average speed was about one-half a mile per hour faster. The fourth machine, a Bayard-Clement, driven by young Clement, was one of the steadiest-running and most perfectly guided cars in the race, and in spite of minor troubles necessitating frequent delays, it carried Clement into fourth position at an average speed of 59.02 miles per hour. Fifth position was won by the popular driver Jenatzy in a 120-horse-power Mercedes, his average speed being 58.51 miles per hour.

Of the eighteen cars entered, two only may be said to have possessed features which differed broadly from the prevailing type. These were the two American cars, the air-cooled Frayer-Miller and the direct-drive Christie. The other sixteen were alike on all the broad features of their design, except one. Seventeen of the cars entered were driven by four-cylinder engines located over the front axle, and of these, eight were driven by shaft and bevel gears, and nine carried the chain drive. Particular interest centers, of course, in the winning car, which, in its dimensions and details of construction, differed somewhat from the rest of the machines. Its wheel base was short and its tread comparatively narrow. The small wedge-shaped radiator and the absence of the usual bonnet over the engines combined to make the machine look smaller and lighter than it really was. As a matter of fact, at the weighing-in it was found to be close to the weight limit. Throughout the race it ran with beautiful regularity, and as it swept by the grand stand it appeared to possess excellent steering qualities.

As to the prospects of the race for the cup in 1907 being held in this country, we think that, in view of the fact that a private course, free from dangerous obstruction, is to be secured, we may see the race run off here, and run off, moreover, under ideal conditions. Although the cup was won by a French machine, France was not officially represented, the entries being made by owners in a private capacity. An Italian car was second in the race, and, of course, the Italians have the privilege of running the race off in Italy, if they so desire. But it is quite conceivable that the attraction offered by a private and special course may prove sufficient to make them forego their right of location in favor of America.

The Latest Death Test.

Although it is asserted by nearly every practising physician that the possibility of being buried alive can only occur where a medical examination has not been made, an eminent German physician and surgeon states that a stronger, absolutely reliable guaranty for discerning actual death is still demanded, and the demand has been met by the discovery of a new medium for ascertaining death with perfect certainty. This new death test consists in injecting a solution of fluorescine deep into the tissues. If circulation exists, the skin and mucous membranes become very yellow and the eyes assume the color of emeralds; if the circulation has ceased, none of these results occur. The discoverer proposes that at least two hours before the body is placed in a coffin, such an injection with fluorescine be made. If life is not yet extinct the injection does no harm, and the coloring within a short time entirely disappears without the slightest injury to the patient.

A New Process for Making Malleable Iron and Steel.

A new process for directly converting iron ore into malleable iron or steel by a continuous system has recently been made by two Australians, Messrs. Heskett and Moore. It is claimed that the new discovery will effect a saving of 25 per cent in the manufacture. The ore is simply concentrated by ordinary methods, or if it is magnetic it is separated electrically until the pure oxide of iron is obtained. The oxide of iron is passed through a revolving cylinder heated by waste gases from subsequent operations, and brought in that cylinder to a dull red heat. It drops from the cylinder to a second similar cylinder, and in the latter it is brought into contact with the deoxidizing gas, which is forced through and brought into contact with the heated ore. The heated ore is thus converted into a pure iron. Accompanied by and protected by the deoxidizing gas, it is passed into a third chamber or melting hearth, where it falls into a bath of molten iron, and is converted directly into steel or balled up as malleable iron.

A New Book Catalogue.

The publishers of the Scientific American have had a new Book Catalogue in preparation for some time, and it is now ready for distribution. Copies are being mailed to all subscribers of the Scientific American, Scientific American Supplement, and American Homes and Gardens. Those who read the Scientific American in the libraries of the Y. M. C. A., or purchase the paper at newsstands, can obtain a copy on application. The Catalogue will be sent free to any address in the world. It contains 112 pages and over 5,000 titles and lists. Special attention has been given to classification in order to render reference easy. We should be pleased to send copies of the Catalogue to any friends of our readers who may be interested in scientific or technical books.

If metallic iron is melted along with copper or brass, it is said that part enters the alloy and becomes chemically combined, and the remainder separates in pellets or nodules of the hardness of steel. These nodules are the source of much trouble in brass, as they injure tools to an alarming extent.

Correspondence.

The Vacuum Process of Preserving.

To the Editor of the SCIENTIFIC AMERICAN:

Referring to the article on the "Vacuum Process of Preserving," in your issue of September 8, I take pleasure in giving you below the answers to the questions in this article and have added other information, which may be of interest to your readers:

1. Yes.
2. Vacuum pressure will not destroy bacteria.
3. The degree of heat required to destroy bacteria varies in every variety of fruit or vegetables.
4. Yes; temperature to destroy bacteria varies according to article to be preserved. This process is used in canneries, but it spoils the fine flavor of the article, and is the reason why canned fruit is inferior to the article put up in homes. Fruit to retain its fine flavor should never be cooked twice.
5. Yes.
6. No.
7. We do not know the source of life of germs; the source of life of anything has not yet been discovered.
8. It is difficult to classify them, as there is such a great variety of germs.
9. None will be destroyed.
10. No.
11. Probably same length of time and same degree of heat.
12. There is no such thing as an absolute vacuum; it has never been obtained with pumps or other scientific apparatus.
13. I do not know the exact degree of vacuum which has been obtained so far.
14. They would not necessarily keep.
15. No.
16. No; its action is not suspended.
17. Perhaps not indefinitely, but enough to spoil the food.

Your correspondent has evidently been under the impression, which is shared by some canners, that a vacuum will destroy germs. To fully understand the vacuum process of canning, we must distinguish between the bacteria floating in the air and those contained in the food itself.

Every process of canning in vogue so far, even with the old style Mason jar, is to some extent vacuum canning. The difficulty in opening Mason jars is caused by the vacuum which was formed at the time the food was put up.

Fruit and vegetables will begin to ferment almost immediately after they have been picked or taken from the soil. Tomatoes will ferment quicker than other fruits or vegetables, and this is the reason why a great many people experience difficulty in preserving same; while they are apparently fresh, fermentation has progressed already so far that only cooking for a very long time will destroy the fermentation.

To put up fruit in canneries in glass jars and to retain its best flavor, the bacteria in the fruit and those floating in the air should be destroyed at the same time, so as to avoid cooking the fruit twice. This can be done by fastening the cover to a jar partially, that is, so that part of the air and the steam can escape, but the greater part of the steam rising from the fruit will come in contact with the cover and by condensation drop back into the fruit.

When the fruit is cooked sufficiently, the cover should be fastened quickly, and upon the jar cooling off a vacuum will be formed.

In addition to this, there is the air which is contained in the fruit itself, which also becomes rarefied during the process of cooking. This rarefied air rises to the top when the jar is cooling and to some extent helps to preserve the fruit. This is most noticeable in preserving apples. A quart jar, which was filled brimful with apples, showed on cooling a shrinkage to one inch from the top, this being caused by the rarefied air leaving the fruit and rising to the top.

Chicago, Ill. RICHARD MURR.

Sun-Spots and Earthquakes.

To the Editor of the SCIENTIFIC AMERICAN:

I see by a dispatch in the daily press that the earthquake in Chile on August 16 was foretold by astronomers there, who based their predictions on the conjunction of Jupiter, the earth, and the moon. The prediction was published in the newspapers there on the day before the catastrophe. Another dispatch from London states that Sir Joseph Lockyer, director of the Solar Physics Observatory, Kensington, says it is a remarkable fact that "the earthquakes in San Francisco and Valparaiso synchronized with a sun-spot maximum, and that in 1894, when there were many serious earthquakes, the same conditions obtained," suggesting that the point is well worthy of investigation.

You published three communications of mine four years ago—on June 21, July 26, and September 27, 1902—upholding these theories that volcanic and seismic actions are partly caused by planetary positions and also by sun-spots; so then let us see how the recent big earthquakes coincide with certain planetary aspects, for it is at least remarkable, whether we admit a cause and effect relation or not.

A very close conjunction of Saturn and the moon with the earth, amounting to nearly an occultation, took place at 2:45 A. M. of April 19 last. The big earthquake that visited San Francisco—and also this place, which is 30 miles distant—and was the severest ever known here, took place at 5:13 A. M. of the 18th, some twenty-two hours before.

There was a conjunction of Jupiter and the moon on August 15 at 1 P. M., and a close conjunction of Mars and Mercury on August 17 at 12 M. The earthquake in Chile came at 7:52 P. M. of August 16, about midway between the two influences, the first shock lasting 4½ minutes and the second 2 minutes, and several hundred more were felt during the following few days, continuing through the conjunctions of Mercury and the moon and Mars and the moon on the 18th, full moon and eclipse on the 19th, and moon on the equator on the 21st.

I wish to call your especial attention to the planetary positions of September 2 to 5, for if there is any truth in this theory of the cause of seismic and volcanic disturbances, they should surely be at a maximum at that period. On September 2 we have full moon at 3 P. M., and the occultation of Saturn by the moon at 7 P. M.; on September 4 Mercury is in perihelion at 7 A. M.; a very close conjunction of Mars and Mercury occurs at 6 P. M., with Mars only 9 min. north, and the opposition of the great planet Saturn with the earth and sun takes place at 7 P. M. Seismic, volcanic, and electric disturbances of many kinds may be expected on and near these dates; also at new moon, moon on equator and perigee, on September 18, 19, and 21 respectively, and at the occultation again of Saturn by the moon on the 29th at 11 P. M.

We are also near the earth's and Saturn's equinoxes, both coming at nearly the same time; hence the unprecedented seismic unrest. A dispatch from Berlin of August 30 says: "The weekly earthquake report of the Geophysical Institute of Goettingen University shows that there were eight earthquakes last week and twenty the previous week. These figures are the highest ever recorded."

Whenever three or more members of the solar system come nearly or directly in line with each other, or one crosses the plane of another's equator, more especially if unusually near to each other, as in close conjunctions and oppositions, equinoxes, perihelions, and perigees of the seven planets, moon, and sun, electrical disturbances seem to be caused throughout the solar system. As to how this occurs, the following theory may account for it: There is probably a perpetual interchange of electrical energy between each two members of the solar system—to maintain an electrical equilibrium, as it were. (We know that sun-spot disturbances are communicated to the earth with the speed of light, causing magnetic aberration.) Now, electricity travels, of course, along the line of least resistance, but as in space the resistance is uniform, electricity travels between planets by the shortest distance—a straight line. Then, when three or more planets come in line with each other or the sun, there would be more interchanging of electricity than usual, and the nearer to each other, of course the more so. One planet might have at times more positive than negative electricity, and others *vice versa*, or more of both than another planet, and an equilibrium would be set up by mutual exchange when they came in line. Also, electricity may be supposed to be thrown off from a planet in all directions along the plane of its equator, hence when this plane intersects another planet we have electrical interchange and unrest. All of which reminds us that what we do not know about electricity and its behavior under certain conditions would "fill a big book," as the saying goes.

The theory of planetary causes of electrical disturbances is by no means new or original, as will be seen by the following extracts from a work on "The Sun" by C. A. Young, Professor of Astronomy in the University of New Jersey, published in 1881:

"There is no question of solar physics more interesting or important than that which concerns the cause of this periodicity [of sun-spots], but a satisfactory solution remains to be found. It has been supposed by astronomers of very great authority that the action of the planets in some way produces it. Jupiter, Venus, and Mercury have been especially suspected of complicity in the matter, the first on account of his enormous mass, the others on account of their proximity. De la Rue and Stewart deduce from their photographic observations of sun-spots, between 1862 and 1866, a series of numbers which strongly tend to prove that, when two of the powerful planets are nearly in line as seen from the sun, then the spotted area is much increased. They have investigated especially the combined effect of Mercury and Venus, Jupiter and Venus, and Jupiter and Mercury, as also the effect of Mercury's approach to, and recession from, the sun. In all four cases there seems to be a somewhat regular progression of numbers, though much less decided in the third and fourth than in the first and second. Loomis suggests that the conjunctions and oppositions of Jupiter and Saturn may be at the bottom of the matter."

In your article on "A Severe Earthquake in South America" in issue of August 25, you mention three other severe earthquakes occurring there recently—the dates being March 27, April 24, and May 5. On referring to the almanac I find: March 27, 7 A. M., conjunction of Mars and moon; March 28, 2 A. M., conjunction of Mercury and Venus; April 23, 9 A. M., new moon; April 24, 7 P. M., conjunction of Venus and moon; April 25, 8 A. M., conjunction of Mars and moon; May 5, moon on equator; May 6, 6 A. M., conjunction of Venus and Mars, Mars north 5 min. There are thus seen to be in the first case two earthquake causes but nineteen hours apart; in the second, three causes in less than forty-eight hours, and in the third, two strong causes in thirty hours, including a very close conjunction. There are but three other dates in March—12, 13, and 25—when the earthquake-planetary causes are so strong; four in April—8, 9, 10, and 18; and three in May—17, 23, and 24.

I would like to see this theory of planetary causes fully worked out and tested, by considering not only the conjunctions and oppositions as seen from the earth, but all lining up of the planets with each other or the sun, and also the equinoxes of the planets and principal satellites. A means of accurately predicting sun-spots, earthquakes, volcanic eruptions, and electrical disturbances in general might be developed.

Livermore, Cal. ELMER G. STILL.

A Motor Vehicle Test.

Plans for a commercial motor vehicle test have been made by the Automobile Club of America. The contest, which will be an economy test, will be held from November 7 to 10, the competing machines being subjected to different tests on each of these four days.

The competing cars will probably not be divided into classes, but will conform to the same regulations, and awards will be made on the basis of the cost of work done per ton mile. If these figures can be obtained with a tolerable degree of accuracy they will be not only interesting, but of wide industrial value, for one of the great difficulties to-day in determining the economical utility of the motor vehicle for business purposes is the lack of trustworthy statistics in determining what similar machines ought to do under practically similar conditions.

The plan as at present proposed is to require the competing cars to run over two routes. One will be the long route, extending from the clubhouse to Kingsbridge, at 230th Street, by way of Central Park West, Amsterdam Avenue, and Upper Broadway, returning by way of Sedgwick Avenue, Jerome Avenue, over Central Park Bridge, down Seventh Avenue to the Park, and then to Fifth Avenue, back to the clubhouse. This will be a twenty-mile route. The shorter route, of ten miles, will run south down Fifth Avenue and Broadway to the Battery, returning by way of West Street, thus taking the cars through the most congested traffic sections of the city.

The Current Supplement.

The current SUPPLEMENT, No. 1607, opens with an article on the flamingo and its queer nest, in which article are described the researches of Frank M. Chapman in Bermuda. Striking illustrations accompany the article. Major Ormond M. Lissak describes methods of measuring the velocities of projectiles and pressures in cannon. Internal strains in iron and steel are discussed by Henry D. Hibbard. Those who are interested in the new alcohol law will, no doubt, welcome the publication of a digest of the regulations which have recently been issued by the Internal Revenue—regulations which will definitely settle in what manner alcohol may be made and denaturized under governmental supervision. The work of the Reclamation Service is described and illustrated. Percy H. Thomas discusses some fundamental characteristics of mercury vapor apparatus. The Atkins dry process of generating acetylene gas is described by the English correspondent of the SCIENTIFIC AMERICAN with the help of diagrams and photographs. A 50-horse-power four-cylinder Crossley vertical oil engine with a new system of governing forms the subject of an interesting article. The usual trade notes and formulæ will be found in their accustomed places.

A parliamentary return has been obtained by Sir Charles Dilke giving the numbers of submarines built or in course of construction for the leading naval powers. France stands at the head of the list with 39 built and 50 in course of construction; Great Britain stands second with 25 built and 15 on the stocks; Russia's figures are 13 and 15; United States 8 and 4; Italy 2 and 4; Japan 5 and 2; and Germany has one submarine in course of construction.

THE CANADIAN PACIFIC RAILWAY COMPANY'S IRRIGATION PROJECT.

BY KITTREDGE WHEELER.

The Province of Alberta, which is seven hundred miles long and four hundred miles wide, is situated west of Saskatchewan, east of British Columbia, and north of Montana. The southern part of this great province is called Sunny Alberta, and the name is well earned. It is a land of mild winters and of perennial sunshine. The soft kiss of the Japan current and the warm breath of the Chinook winds are felt through its sheltered valleys and over its open plains, and horses and cattle range at will the winter through without being fed or sheltered.

The main water supply is the noble Bow River, which heads the Great Divide well up in the very heart of the Rockies, whose peaks are covered with perpetual snow; whose deep and rugged chasms are the glacier's home, and therefore the source of an inexhaustible water supply—the winter's store for summer's need. Unlike many other rivers, the banks of the Bow are not deep-cut below the plain, but are near the lands to be irrigated, and the supply at low water is more than double the demand.

In Canada all the rivers belong to the crown, and are under the immediate supervision of the government; they are measured and meted out by government officials, so that the water right is as good as the land title, and the stipulated supply is guaranteed with both.

The great tract to be irrigated by the Canadian Pacific Railway Company lies in southern Alberta between Calgary and Medicine Hat. It is one hundred and fifty miles in length and forty miles in width, lying between Red Deer River on the north and the Bow River on the south, and through its very center runs the iron way of the Transcontinental Railway.

This great irrigation block is the largest individual block on the continent, comprising over 3,000,000 of acres, and it presents the happy combination of irrigable and non-irrigable areas in desirable proportions for grazing and crops, for ordinary and intensive farming.

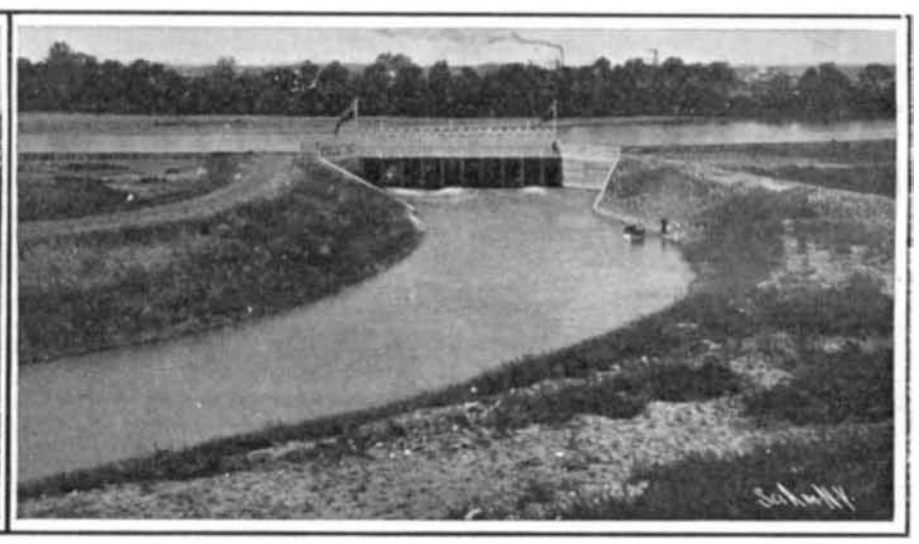
In laying out this undertaking, the block has been subdivided into three main divisions of eastern, central, and western sections, containing about 1,000,000 acres each. The irrigation development is beginning with the western section.

The great plain comprising the block has a natural incline from west to east of some eleven hundred feet, and lends itself readily to the location of the great canals and secondary ditches. The main canal of the western section heads in the Bow River, about two miles east of Calgary, and is 17 miles in length; it is 60 feet in width on the bottom and 120 feet wide on the water line, and it carries 10 feet of water. It terminates in a natural reservoir 3 miles long, ½ mile wide and 40 feet deep. From this reservoir extend the secondary canals A, B, and C, which are 30 feet wide at the bottom and 60 feet at the water line, and these carry 8 feet of water, and their combined length is 150 miles. From these secondary canals the distributing ditches run over the plains, aggregating in the great western section alone a total length of some 800 miles, making a grand total for the western section of 967 miles of main water channels, exclusive of the farmer's laterals.

In most other irrigation projects on this continent the general plan has been to carry water in a secondary canal or ditch to a point near a considerable area to be irrigated, and then leave the farmers to combine in digging and maintaining ditches, at their own expense, to deliver the water to their several farms; but this company is making the signal departure of carrying the water direct to each individual farm, leaving nothing for the farmer to do but to open up the small furrow laterals on his own lands.

The construction of the canal in the western section with its hundreds of miles of secondary canals and distributing ditches has been a large and expensive undertaking. The engineering surveys have been rigidly scientific and exhaustively performed, the contours of the entire western section being located to 5-foot intervals. In the two remaining sections of over 2,000,000 acres it is intended to complete the topographical surveys to show contour elevations within the remarkably close scale of one foot, and in all the sections the maps issued show the exact acreage of irrigable land on each farm.

A Standard Highway Bridge.



Headgate of the Main Canal.

The total excavation in the main canal of the western section was approximately 2,500,000 cubic yards; secondary canals A, B, and C about 5,000,000 cubic yards, and in the distributing ditches 750,000 cubic yards, making a grand total excavation for the western section of 8,250,000 cubic yards. At one point it was necessary to cut away the top of a jutting cliff 1,000 feet long, 180 feet wide and 100 feet deep.

Steam shovels and small construction locomotives were used in excavating the large canals and ditches, and in carrying out the earth, and, wherever possible, elevating graders were used, employing steam and horse power. In the construction of banks the greatest care and skill have been shown. The porous surface soil has been stripped off and the harder clay and excavated soils have been used for filling in depressions and building the banks. In building the banks the soil was put on in layers, wetted down, and then packed by rollers to make them strong and water-tight, so there is little danger of breakage or loss from seepage. The soil through which the canals are dug is very hard and clayey, so there is little seepage or erosion.

The intake receives the water, as has been stated, from the Bow River some two miles below Calgary, and when the water was first let on, although only two of the twenty headgates were open, that is, only one-tenth part of its possible flow, yet in the very short space of forty-six hours the water had reached the extreme end of the main canal, a distance of seventeen miles, and the difference of level at the intake and the

A Huge Cut on the Main Canal.

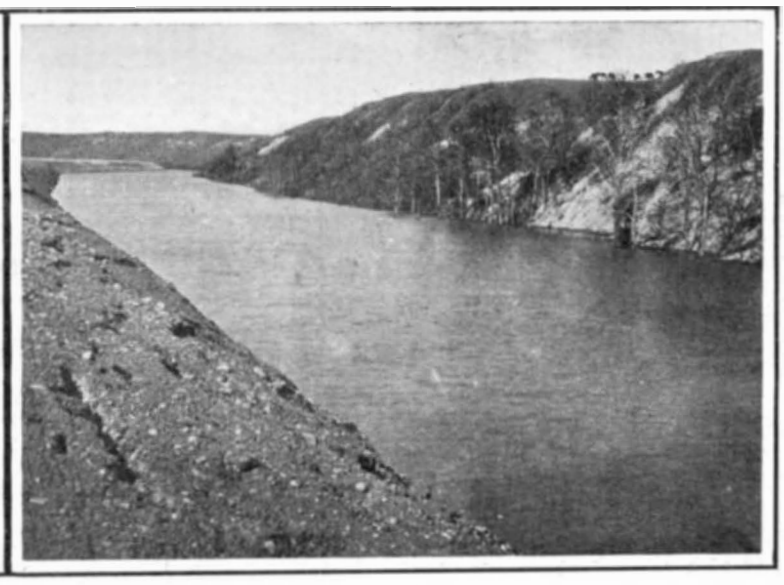
THE CANADIAN PACIFIC RAILWAY COMPANY'S IRRIGATION PROJECT.

end of the canal was only one inch. This was a remarkable showing, and speaks well for the engineering skill displayed in locating and constructing the canal.

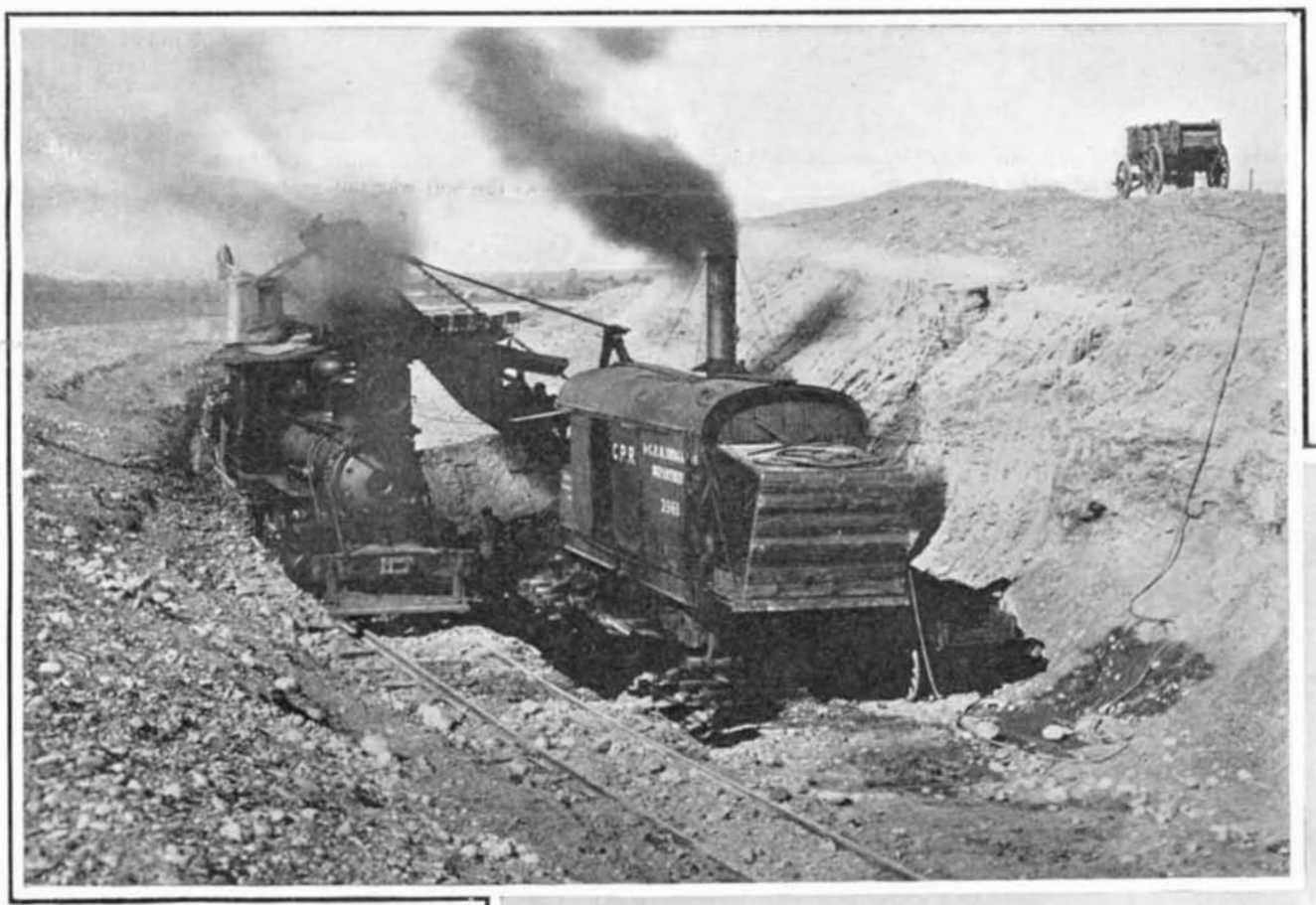
A large amount of heavy timber has been used in the construction. At the great intake just below Calgary, for the protection of the headgates, a double row of heavy piling has been driven along the river's front for several hundred yards. Farther down the main canal a large spillway has been introduced by means of which, in case of needed repair, or for any other cause, the water can be entirely drained off into the Bow River.

At several points on the main and secondary canals the slope of country necessitated the construction of falls or "drops" which carry the water safely to the levels below, without erosion of sides or bed.

Team Excavations on the Main Canal.



Along the Main Canal.



A Steam Excavator at Work.

If the same proportion of mileage and excavation obtains in extending the irrigation system through the central and eastern sections of the block, this scheme will ultimately embrace a total of 2,900 miles of canal, and the excavation of the enormous mass of 24,750,000 cubic yards of material.

The Bow River has an abundant natural storage, not only in the deep snows and mighty glaciers of the Rockies, but also in the many mountain lakes which pour their overflow into the river. Devil's Lake alone is 12 miles long, ½ mile wide, and 40 feet deep, and its great basin is available for storage. In addition there are many other places where the storage of enormous bodies of water can be effected, but the river has in itself a capacity of 6,000 cubic feet per second during the irrigation season.

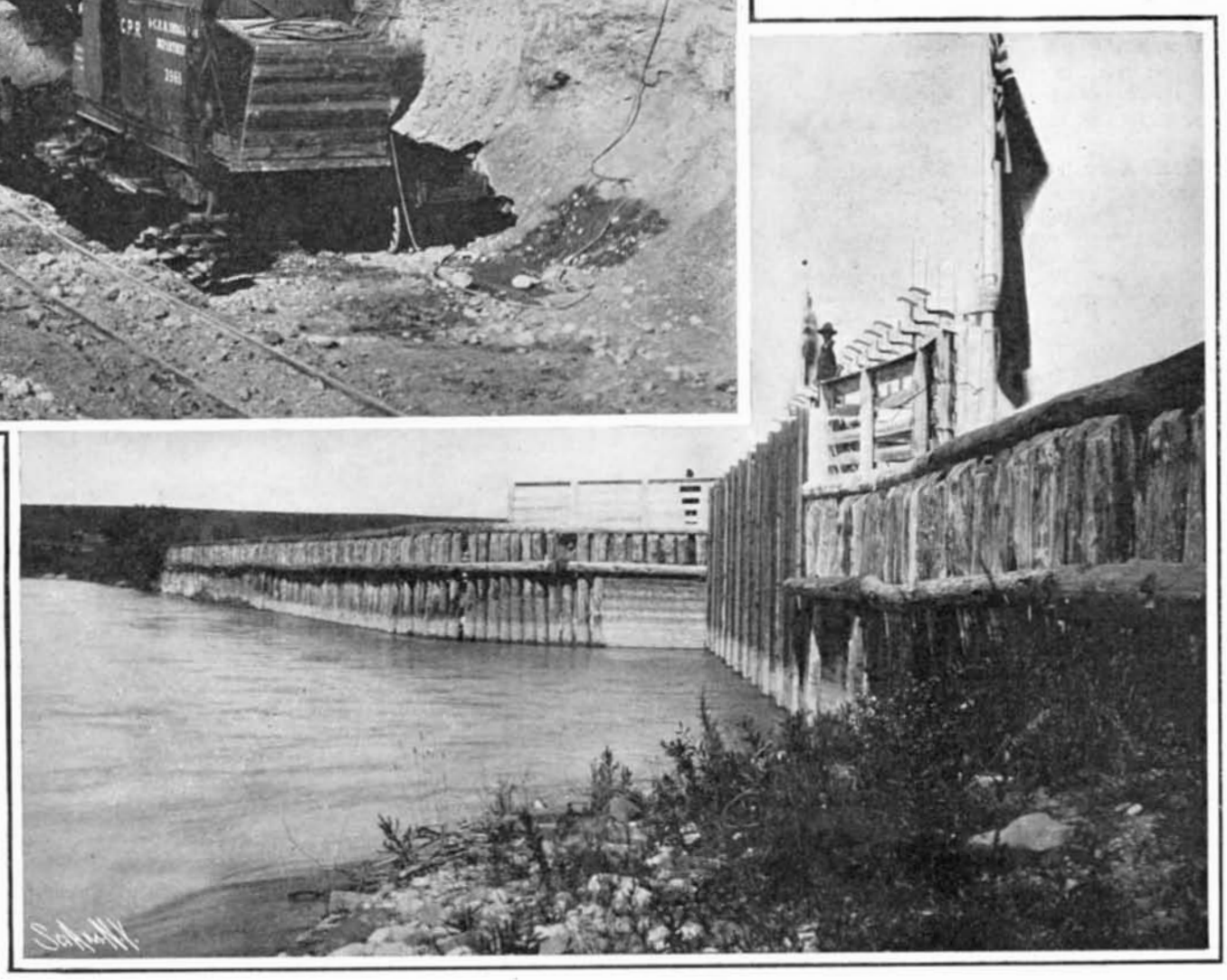
It may be of special interest to note that the water is being supplied to the farmer in this great scheme at 50 cents per acre per annum, the duty being 1 cubic foot per second, flowing continuously, for 150 acres, and in selling irrigable land an allowance of 10 per cent of the area is made for the space to be occupied by farm buildings, etc. Demonstration farms have been opened in the western section, and next year will show the wonderful possibilities of the irrigation of land under this canal in southern Alberta.

In comparison with other irrigation undertakings the project of the Canadian Pacific Company is the largest on this continent and ranks with the great irrigation schemes of the world. I have ridden on donkeys or walked on foot over the rich irrigation strip of old Egypt, but Egypt, from Cairo to the First Cataract of the majestic Nile, is small compared with the great domain contained in this irrigation block.

The abundant water supply, the easy slope of the land, the rich and level country through which the great canal runs, with all the possibilities of the most diversified farming, the happy combination of grazing and irrigable lands in the same quarter section, the absolute security of the water right from the crown, and the supply of water needed during the irrigation season guaranteed by the Dominion government—all these conditions promise a bright future for irrigation in southern Alberta.

It is filling up rapidly with farmers from the Western and Central States. Ninety-five per cent of the present settlers in this part of the province are Americans. This great irrigation block has room for half a million people and a capacity to feed two millions. The Canadian Pacific Railway has intrusted the development and completion of this great project to Mr. J. S. Dennis, a well-known civil engineer of the Dominion, now assistant to the second vice-president of the road, and his skill and indomitable determination have had much to do with its present realization and its great future possibilities.

A steel-making company in Indiana has given the largest single order for gas engines ever placed by one company. It is for eight gas engines of 3,000 horse-power each, capable of delivering 30,000 cubic feet of free air per minute to the furnaces which produce the blast-furnace gas, which, in its turn, is also used to operate the engines.



Headgate and Piles for Protecting the Banks of the River.

THE CANADIAN PACIFIC RAILWAY COMPANY'S IRRIGATION PROJECT.

AN ELECTRIC POWDERLESS, SMOKELESS, FLASHLESS, AND SOUNDLESS GUN.

BY OBED C. BILLMAN.

While but two patents have been issued by the United States Patent Office for electro-magnetic guns, and these within the past two years, yet it appears that scientific men gave this problem their attention a number of years ago.

In 1845, Charles G. Page, of the Columbian (now George Washington) University, Washington, D. C., wrote an article, which was published in the American Journal of Science and Art, vol. 49, page 132, in which he stated:

"Another curious instrument is the galvanic or magnetic gun. Four or more helices arranged successively constitute the barrel of the gun, which is mounted with a stock and breech. The bar slides freely through the helices, and by means of a wire attached to the ends toward the breech of the gun, it makes and breaks the connection with the several helices in succession, and acquires such velocity from the action of the four helices, as to be projected to the distance of forty or fifty feet."

The primary principle involved in the construction of these guns consists in impelling the projectile by the magnetic action of a solenoid, the sectional coils or helices of which are supplied with current through devices actuated by the projectile itself. In other words, the sections or helices of the solenoid produce an accelerated motion of the projectile by acting successively upon it.

A principle somewhat similar is involved in the construction of electro-magnetic rock drills and dispatch tubes. Patents granted to Marvin, Nos. 361,829 and 368,405, are instances of the former, and patent No. 259,817, granted to Cheever, is an instance of the latter.

In the electro-magnetic rock drills, the plunger is moved by the action of a sectional solenoid, through the coils of which current is supplied through contacts closed by the plunger itself.

The electro-magnetic dispatch tube consists of a carrier or dispatch tube surrounded by a series of coils or helices, a galvanic battery having one pole permanently connected with one end of the coils or helices by a series of branch wires, the other end of the coils or helices being left open circuited, a traveling carrier provided with circuit-closing devices for completing the circuit between the open ends of the helices, and a conductor connected directly to the other pole of the stationary battery.

An advance sheet of Consular Reports, dated February 27, 1902, contains an account of an electro-magnetic cannon in Sweden, as given in a report by Consul-General Bordewich, under date of "Christiania, January 25, 1902."

"Prof. Birkeland (who two years ago was sent by the government to northern Norway to study magnetism, the aurora borealis, and cloud formations) is engaged in the construction of a cannon with electro-magnetism as the motive power in place of explosives. A small model of the invention throws projectiles weighing a pound with great force."

A patent was issued to Kristen Birkeland, of Christiania, Norway, for the invention above referred to, March 15, 1904, No. 754,637, and this was the first patent issued by the United States Patent Office for an invention of this class.

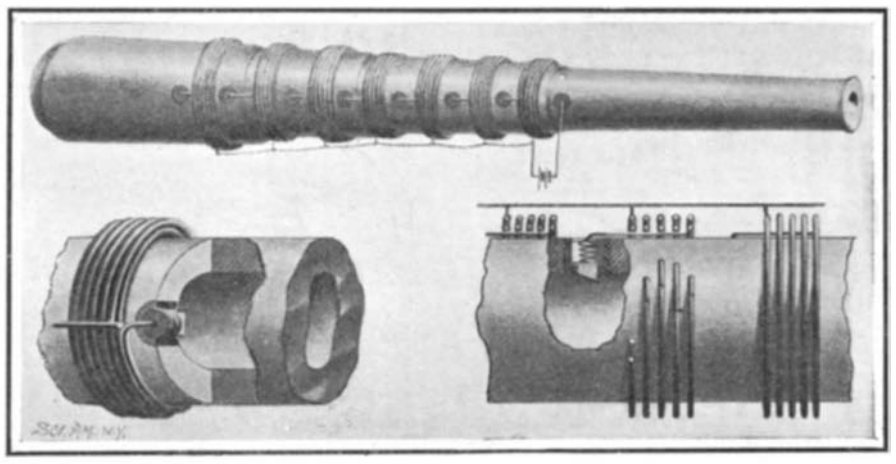
The application of Birkeland was filed January 2, 1902, and Samuel T. Foster, Jr., a native of this country, residing at Victoria, Tamaulipas, Mexico, having read the account of the Birkeland invention, as referred to in the Consular Report, filed an application for Letters Patent December 10, 1902, but owing to the difference in the construction of the guns disclosed in the two co-pending applications, no interference was declared.

The broad claims originally filed by Mr. Foster were held to be anticipated by the Journal article above referred to, but a patent was finally allowed and issued to him February 6, 1906, for an electric gun, No. 811,913, the second patent issued in the United States for an invention of this class. One of the practical difficulties encountered in the construction of a practical electro-magnetic gun arises from the fact that the modern methods of electrical calculation would indicate that in order to obtain service velocities with service projectiles an enormous number of windings would be required, thus involving the use of a barrel whose length would be prohibitory.

Another difficulty arises from the fact that in order to give the projectile a service velocity, without an enormous number of windings, an abnormally heavy current—that is to say, a current beyond the safe carrying capacity of the solenoid—is required, and hence the temperature of the solenoid will be raised to a point sufficient to destroy it.

Prof. Birkeland attempts to overcome these difficulties by supplying an abnormally heavy current to a coil and then cutting off the current from the coil before the temperature of the coil has reached such a point as to injure or destroy it, claiming that the rate of increase of the temperature depends upon a number of factors other than the current.

Mr. Foster says, in the specification of his patent:



THE FOSTER ELECTRO-MAGNETIC GUN.

The projectile is impelled by the magnetic action of a solenoid, the sectional coils of which are supplied with current through devices actuated by the projectile itself.

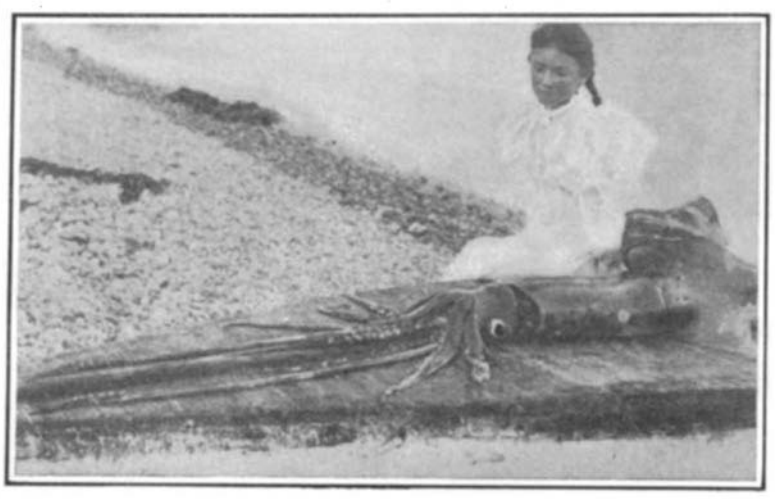
"All projectiles used in this gun must have magnetic properties, and projectiles of iron or containing large portions of iron are preferable. That projectile having the greatest magnetic permeability is most suitable for this gun." The Foster gun is very simple and comprises a barrel surrounded by a series of coils or helices, a series of openings arranged along the barrel and provided with insulated walls, a series of connector-plugs mounted in said openings and normally adapted to be engaged by the projectile, a series of springs mounted in said openings and adapted normally to hold the connector-plugs in contact with the insulated walls, and an electric generator connected with said helices and barrel.

In this way means are provided for energizing and de-energizing the coils or helices in regular sequential order by the projectile completing and breaking their circuits and for automatically keeping the center of their electro-magnetic field just ahead of the projectile until it has reached the center of the last electro-magnetic field. When the projectile has reached the last electro-magnetic field, means are also provided for opening the battery circuit and releasing the projectile of all further electro-magnetic action of the gun.

PHOTOGRAPHING A DEVIL FISH—THE CHAMELEON OF THE SEA.

BY CHARLES FREDERICK HOLDER.

The strange spiderlike creature known as the octopus or devil fish comes of an ancient lineage. Its family tree includes shelled animals which held sway in the Silurian sea millions of years ago. The late Prof. Newberry, of Columbia University, referred to a certain *Orthosceros titan* which may have weighed a ton—a torpedo-shaped creature with a shell twenty feet in length, which doubtless played havoc among the denizens of the abysmal regions of ancient seas. Again, there were others, with nautilus-like shells, as large as a cart wheel; and the most forbidding living animal to-day, the one shrouded by the greatest mystery, is the giant squid, a cousin of the octopus, which lives in deep water, only occasionally being found, as was one recently, off the Southern Californian coast, floating, a great white mass, so bulky that the boatman who saw it told me that not only could he not take it aboard, but it was so huge that he could not tow it in. The arms of this specimen he described as being as large as a man's leg, and doubtless this ten-armed devil fish attains a length of one hundred feet and a weight of several tons.



A Sixty-pound Devil Fish so Powerful That One Man Could Not Tear Its Arms from the Boat.

PHOTOGRAPHING A DEVIL FISH—THE CHAMELEON OF THE SEA.

The keeper of the Avalon zoological station, who had an uncanny experience with a large devil fish, or octopus, related the incident to the writer. He said: "I was fishing at the time with several partners out of San Francisco. It was our custom to go out to the banks around the Farallones and try for deep-sea fish. It was a rough place, nearly always blowing half a gale, foggy and dangerous, and often we had to let lines go and run in to lie in the lee of the rocks. One morning I was hauling in the trawl when it stopped coming. I thought I was foul of a rock, so pulled hard, and after a while felt it give and begin to come up, but very heavy. It's slow work hauling in a trawl, taking off a fish and killing sharks that get hooked, and it was some time before I got what I supposed was a rock. I had just taken a turn about a rowlock with the line, to rest, when it sagged, and looking over I saw a great mottled ball out of which shot a long arm that took hold of the gunwale and held on. We often caught devil fish, and there was a demand for them in the market, so I tried to pull it up; but another arm came up, as big as my own, while another crept over the side near my partner, who started up, shouting that it was coming aboard. I looked over and saw a great red mottled mass hanging to the bottom of the boat; then I reached for a knife—a kind of cleaver—my partner doing the same. The devil fish was caught by several of the trawl hooks, and tried to fasten to the boat to get rid of them. Its arms shot out of the water like fingers, and when I saw one the size of my arm and growing bigger near the base, I didn't wait, but slashed at them right and left, cutting them on the rail. Some of the tentacles near the body looked as big around as my leg, and the whole arm or feeler was nearly twice as long as a man. The arms were probably twelve feet long, and the body two or three times the size of a man's head. The whole mass was so big that we were glad to chop it to pieces as it came aboard, and then to punch it away from the boat with oars and get rid of it; it was too heavy to take aboard, especially in a seaway."

A number of large devil fishes have been taken near Tacoma, and when spread upon the grass are seen to be formidable creatures, with their enormous button-like suckers, which combined constitute a power sufficient to drown men in the open water. Monterey has produced a number of large specimens which would terrify strollers along the weed-covered rocks at low tide.

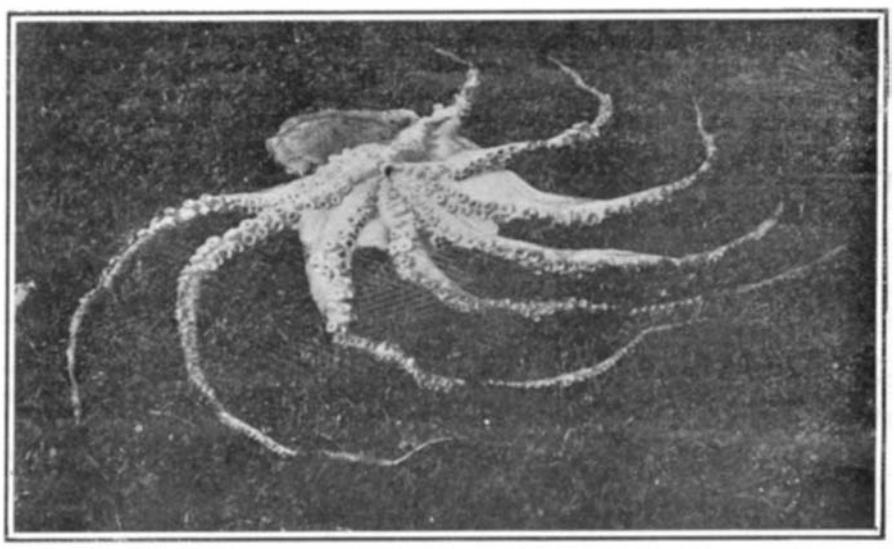
It was my good fortune to have under examination at Avalon, Santa Catalina, at various times, several large living devil fishes and a squid, the latter eight feet in length. The devil fishes were first noticed on a point of rocks at the north end of Avalon Bay. I was lying on a rock watching the movements of some land crabs which kept retreating from the water as the tide rose, when suddenly a crab dashed frantically from the water, and out after it "galloped"—there is no other word for it—a devil fish nearly two feet across. The animal continued the chase a short distance, lifting its tentacles in the air in a sort of overhead motion, then finding the pursuit hopeless it withdrew, with the peculiarly unpleasant writhing, gliding motion characteristic of these animals, and upon reaching the water stationed itself just at the edge, so mimicking the color of the bottom that when I glanced away and looked suddenly back, I could not at once distinguish it. This devil fish had the appearance of a cat watching for mice, and when a crab was seen it would shoot out a long, attenuated tentacle and attempt to seize it. By carefully insinuating my way to the water's edge I quickly grasped the specimen, and after a short struggle tore it from the rocks and secured it. At various times I had from three to five devil fishes in an inclosure, where I could watch them change color and test their strength. In confinement, if the tank bottom was dark, they assumed various tints, generally a dark reddish brown; but the largest one was a tiger-like creature, about three feet across with a ground of livid white covered with black or dark gray blotches, giving it a truly fiendish appearance, especially as the eyes were conspicuous and appeared to emit lambent gleams. The change of color was marvelous in its rapidity. In a special tank

in which two of these prisoners were confined they occupied the corners, facing outward, with arms either coiled under or above them. At any offensive movement on my part, presenting my hand under water, the color scheme would change. A blush appeared to me; but with the tiger, the black and white chameleon, him of the stripes, spots, and blotches, the approach of my hand under water was a menace, and all his movements were essentially cat- or tiger-like. Perhaps you have seen a lynx, wildcat, or mountain lion creeping upon its prey or preparing to jump when treed. There is a concentration of legs, trembling muscles, constant stepping of the feet in a limited area, bending of the back and switch of the tail, long or short. In this devil fish eight arms coiled about it like snakes trembled and vibrated as I thrust my hand down into its den. Colors raced over it as I bent over and watched it closely from the outside, where I could see through the polished plate glass every movement, throb, and change. At a distance of eight inches I could feel the curious current of water shot at my hand by the torpedo-like siphon; see the delicate weed in the water blown aside; and as my hand approached nearer and nearer the octopus crouched low, like a cat, its eight arms fumbling inanely, a trembling, Medusa-like object. Nearer came my hand, and like a flash of lightning, so sudden that it was startling, the octopus shot out one of its arms, that like a snake or lariat seemed to be flung at me, the rings of the end suckers striking my hand sharply, the entire animal springing forward, as shown in our illustration, the photographer, who had placed his camera for the purpose of taking some characteristic poses, catching the animal just as it was about to spring. To brace itself, it threw one arm to the right, one below, one to the left, fastened by many suckers to the glass, while two others, as the sequel will show, seized its companion.

I now gradually withdrew my hand from what may be considered the attack, to allow the photographer to insert a plate. This accomplished I again advanced my hand, and doubtless to the devil fish the situation was momentous and alarming. It crouched a moment, moving forward and back, then launched itself bodily at the enemy (my hand), striking it with several tentacles, dropping back quickly and crouching for another spring, the action so sudden and forceful, so startling, that the corner octopus sprang into the clear water and for a moment literally danced, floated, or poised, uncertain which way to go, then dropped to its corner again, rendering itself as inconspicuous as possible.

Again I retreated, to allow the photographer to reload with another plate and refocus; the big devil fish meantime crouching and spreading itself out, color melting color, tint, and shade over its broad back, directing its siphon stream at its companion. All being ready, I again advanced, pointing my finger at the animal and moving to within a foot of it. I could see it darken, take on a deep red hue, and then it flung itself bodily at my hand, and endeavored to cover it by a peculiar encompassing motion designed to smother it. A crab or fish is taken in this way, the web being spread over it, shutting the victim in its arms, and the scores of suckers forcing it to the mouth, where the nipping black parrot-like beak is brought into play. But the smothering action is invariable; suggestive and horrifying if we imagine it attempted by an animal thirty feet across. To meet this leap, holding the hand steady, and grasping the octopus, is a nerve-test to a novice. I confess that it was distinctly disagreeable to me, though I have caught and handled many of these animals of various sizes; but I held the devil fish while the photographer took a third picture, showing the duel a second after the contact. The octopus had enveloped my entire hand, and by grasping it firmly I pressed my little finger over its bills, my palm over its eyes, and held it with all my strength.

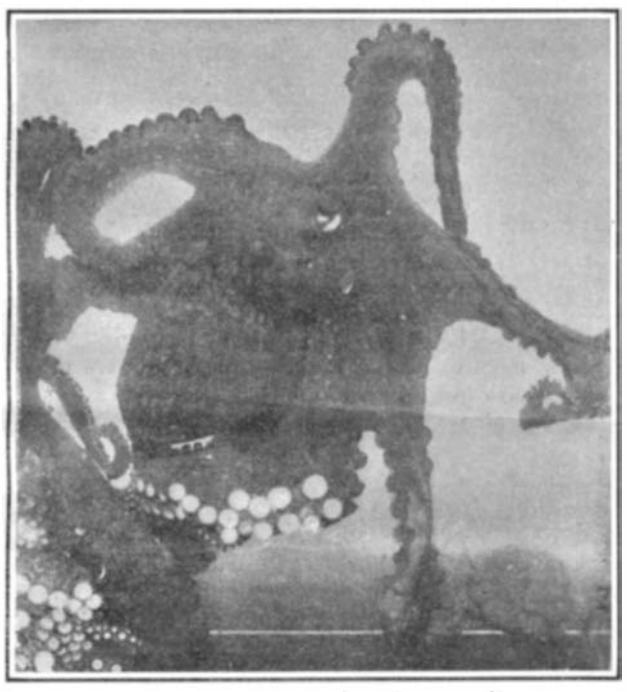
Upper Surface of a Devil Fish Measuring 20 Feet.



Under Surface of the 20-Foot Devil Fish.

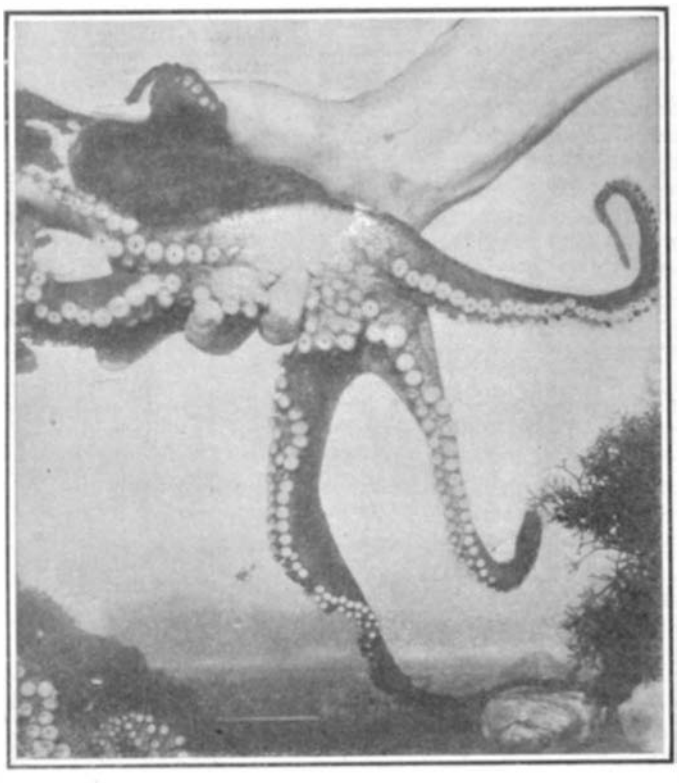
pass over the entire surface; and in a large squid I can only compare it to heat lightning, a rapid and continued series of flushing and paling, from deep brick red to gray. It was very evident that the animals differed much in pugnacity. Some did not resent my touching them; others merely threw a tentacle in my direction, while one never touched me, but directed its siphon at my hand under water and sent a violent current in that direction, apparently endeavoring to blow my hand away. It was fascinating to observe the "range" this water gun had, and how by seeming intuition the devil fish could direct it at my hand as I slowly moved it about while attempting to attract the animal's attention in an opposite direction. The assumption was almost irresistible that the siphon, that is well shown in the figure, just beneath the eye, had a sense of its own, and could be directed at my hand and made to follow it while the eyes of the octopus were looking in another direction. But the latter are elevated, and doubtless not a move of my hand (a supposititious enemy) which was passed about and around it in the tank was lost to this uncanny chameleon of the sea.

This devil fish, that flushed and danced about in the water, assuming strange postures — now crouching in a corner, now poised midway—was in a sense indifferent to

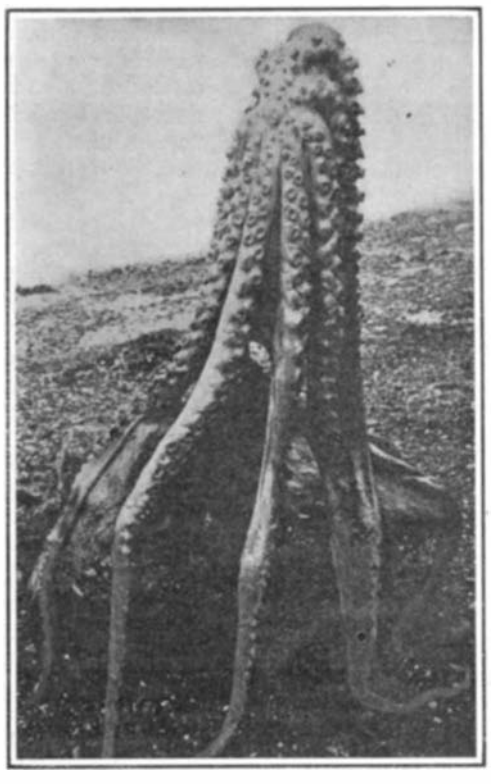


Devil Fish About to Leap.

Two Fighting Devil Fishes Preparing to Spring at Each Other.



Holding the Devil Fish to be Photographed.

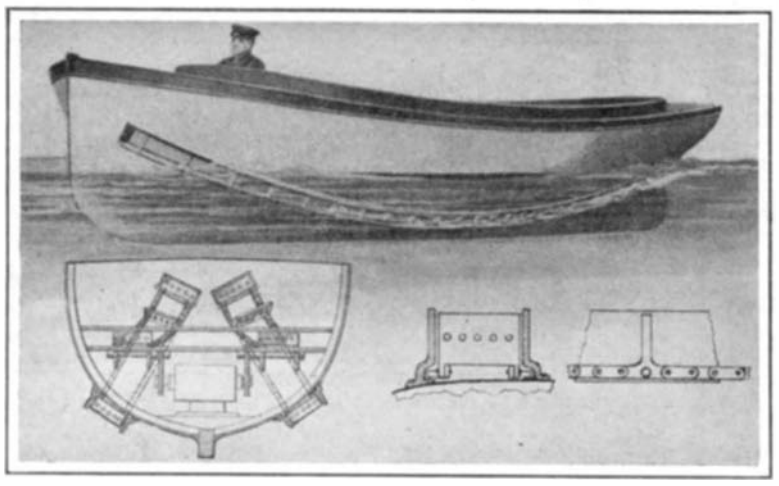


Ready to Spring.

PHOTOGRAPHING A DEVIL FISH—THE CHAMELEON OF THE SEA.

The animal held me tightly with one tentacle over my thumb, another through my fingers, and bracing itself by throwing out three anchors below, which caught the bottom and two sides of the tank, and three behind.

I now endeavored to complete my pseudo-victory by lifting the octopus, but I could not tear this small animal from the sides. The devil fish held on, pumping a stream of ink at me in its rage. By using my other hand I finally succeeded in prying it off; then I pretended to be caught and tried to release it. But the warlike chameleon of the sea would have none of it. It threw its tentacles about my hand, pulled it



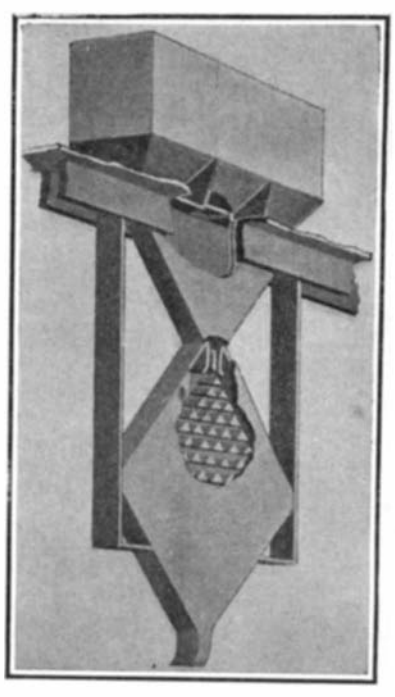
A BOAT DRIVEN BY PADDLE-CHAINS.

slowly down into the corner, covered it as well as it could, but did not bite me. If my hand had been a crab, fish, or other octopus, it would have been attacked and bitten, but for some reason it did not attempt it; in a word, the animal was perfectly harmless, which I knew; there was only a slight scratch on my hand to tell the story, and this was received when I wrenched it away.

This was a laughable conclusion to the threatening and warlike movements of the octopus. The animal, in point of fact, was a "bluffer," and well calculated to demoralize one not acquainted with its limitations. I know of no animal that has the power, by mere attitudinizing and the assumption of menacing gestures, to inspire the same degree of horror in the spectator not familiar with it. This was illustrated when I requested an attendant when displaying this octopus to explain to visitors that it was perfectly harmless, then to enrage it, and ask spectators to take it out of the tank and place it in another, a substantial inducement being offered in one instance. But among the many observers not one could be found who would touch the quivering, color-changing creature poised for its harmless spring; the terror inspired was complete and intense.

APPARATUS FOR MIXING DIFFERENT GRADES OF RICE.

Pictured in the accompanying engraving is an apparatus for blending different grades of rice or other cereals. The design of the apparatus is such that the blending is effectively accomplished in a very simple manner without the use of power-driven machinery. It comprises essentially a series of feed hoppers for the different grades of cereal, a large receiving hopper into which the feed hoppers empty, and a mixing chamber into which the receiving hopper discharges. The mixing chamber has the form of a lozenge, and the interior is provided with a grid or a series of transversely-extending bars of triangular cross-section, which are so spaced as to form passages for the rice to insure a thorough mixing. The series of bars also forms a lozenge-shaped figure, but its sides are not parallel with the chamber, so that tapered channels are provided between the grid and the chamber which, at the top, assist in crowding the rice through the grid and at the bottom flare open to accommodate the flow. The lower end of the chamber is formed with a spout adapted to guide the cereal into a bag or other receptacle. A gate is provided in the lower end of the receiving hopper, whereby the operator can control the flow of the grain. It will be noted that the bars are not promiscuously distributed in the mixing chamber, but that there is a method in their arrangement. They are set in horizontal rows, the bars in one row alternating with those in the next row above or below, and each bar set with its lower face horizontal, so that the other two inclined faces serve as deflectors for the grain. The materials flow downward by their own gravity and, consequently, no power mechanism is required. A patent on this improved mixer has been granted to Mr. P. M. Lyons, of Gueydan, La.



APPARATUS FOR MIXING DIFFERENT GRADES OF RICE.

A NEW METHOD OF PROPELLING A SHIP.

Instead of employing the conventional screw propeller or the paddle-wheel, Fénélon Pélissier, of Gonaives, Haiti, has hit upon an entirely different principle, which he has protected by a patent.

Mr. Pélissier uses two endless chains which pass around the hull from bow to stern, and which carry blades. The chains in question run in and out of openings in the hull, fore and aft, and are guided by sprocket wheels. In order to drive the chains by the ship's engine, sprocket wheels are provided within the hull, which sprocket wheels are carried on a shaft connected with the engine shaft. Thus it is possible to drive the ship continuously.

In order to guide the chains effectively, special keelsons are employed, so formed as to constitute chain-runs, as shown in one of our sectional views.

The chains on opposite sides of the craft are driven independently from the engine. In order to turn quickly, one chain may be driven forward, and the other toward the stern. In order to move forward or astern, both chains are driven in the same direction.

A special arrangement has been devised for applying the invention to existing ships.

Fireproof Celluloid.

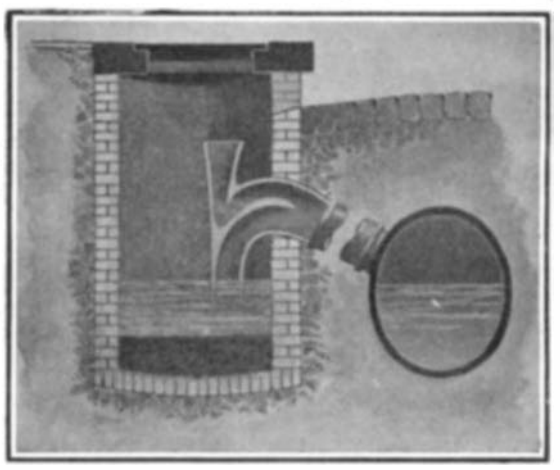
A process has recently been invented for rendering celluloid non-inflammable. In its broad principles the process may be said to consist of introducing into the mass of celluloid, when it has reached the highest degree of fluidity during its manufacture, a certain quantity of a salt, such as phosphate, bicarbonate of ammonia, or magnesium, or still others. These salts possess the property of giving off under the influence of heat a great quantity of gas, which stops the progress of the combustion. It is claimed that quantities of uninflammable celluloid can be manufactured by the new process into any form and size desired.

Feeding Cattle on Sugar.

Recent statistics show considerable progress in the employment of "doctored" sugar for the feeding of cattle. The consumption, which reached 50,000 pounds at the end of December, 1905, rose to 200,000 pounds in January, 1906. If this custom were general, 500,000 tons of sugar would be consumed annually, say half of the present production, giving every day 100 grammes (3.5 ounces) of sugar per head of black cattle. The sugar can be doctored only within the inclosure of the sugar-refinery and under the conditions determined by a regulation of the public administration. To 100 kilos (220 pounds) of sugar are added 2 kilos (4.4 pounds) of salt and 20 kilos (44 pounds) of oil-cake, or of any powder whatever approved by the administration. This mixture circulates freely and is sold at from 20 to 22 francs ($4.00 to $4.40) per 100 kilos, say about the price of the oats, with which, at the moment of serving, it is mixed in the proportion of 20 per cent. Thus 1,000 kilos of oats and 200 kilos of sugar will give 1,200 kilos of sugared oats, which will be distributed, for example, at the rate of 8 kilos instead of 10 kilos of pure oats. This fodder, therefore, is economical. For oxen the sugar is mixed with chaff. Doctored sugar is beginning to be used also for the disinfection of stables, for its combustion gives a plentiful release of formol.

MEANS FOR FACILITATING THE CLEANSING OF STREET CATCH BASINS.

In place of conducting the water of the streets directly into the sewer main, it is customary in large towns to provide catch basins at intervals into which the gutters drain. These basins are then connected by siphons with the sewer main, so that when the contents rise above a determinate level, they will be drawn off through the siphons. Heretofore the only means of cleaning catch basins has been to dip out the contents in bucketfuls and convey them to some other basin, whence they are siphoned off into the sewer after the necessary level has been reached. This method of cleaning the basins is both laborious and expensive. However, a new form of siphon has recently been invented by Mr. William H. Engelbrecht, of Prince Bay, N. Y., which simplifies the cleaning process. This siphon is shown in the accompanying engraving. It will be observed that the shorter leg, or that portion of the siphon which enters the basin, is formed with a double channel or passage, one channel lying above the other. The upper channel is provided

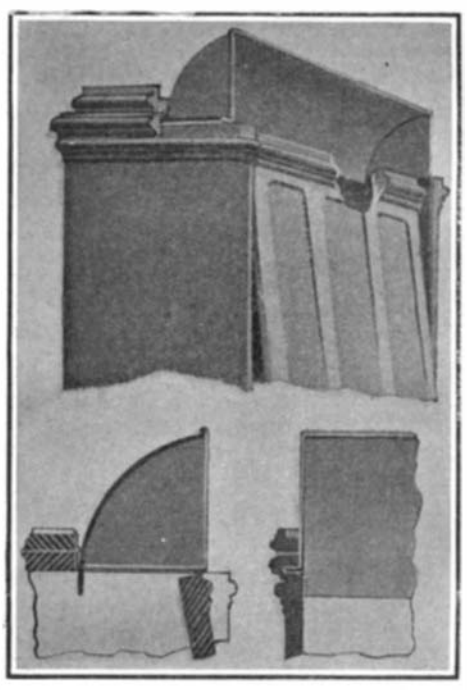


MEANS FOR FACILITATING THE CLEANSING OF STREET CATCH BASINS.

with a funnel mouth opening upward. In use the contents of the basin are dipped up and poured into this funnel, whence they flow down the longer leg of the siphon to the sewer main. The upper passage is so designed as to form a trap or water seal, so that after cleaning out the basin a quantity of clean water is emptied into the funnel, to clear the trap of foul liquid or sediment, and provide an effective seal against the escape of sewer gas through the siphon into the basin.

SOUND DEFLECTOR FOR PIANOS.

It does seem rather odd that the source of music in a piano should be completely boxed up in a case, so that the sound waves must first penetrate the case before they can reach our ears. To be sure, some pianos are provided with a swinging front, and a hinged lid at the top, which may be opened to prevent complete muffling of the sound; but the sound is deflected downward by the hinged front, or passes directly up to the ceiling when the top of the case is open. In the accompanying engraving we illustrate a device which may be placed over the open top of the piano to deflect the sound waves issuing therefrom, and direct them to the audience in the room or concert hall. The deflector is a very simple device of light construction, comprising two end boards connected by a curved back of such form as properly to direct the sound into the room. The end boards are formed with cushioned flanges adapted to rest on the side walls of the piano case, while the curved back is formed with cushioned extension, which fits between the side wall and thus prevents lateral displacement. In consequence, the deflector does not need to be fastened in place, but may be readily set in position or removed without operating any fastening means. By its use the full volume of sound passes in concentrated form into the room without being diffused. A patent on this sound deflector has recently been secured by Mr. T. W. Freeborne, of 228 Spring Street, Newport, R. I.



SOUND DEFLECTOR FOR PIANOS.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

CUFF AND SLEEVE PROTECTOR.—C. H. OVERMAN, Marion, Ind. This device is formed of wire suitably covered, and is designed to be slipped over the wrist of the person using it, and is provided with means for engaging the cuff or sleeve and holding it in an elevated position while the hands are being used in any manner that would tend to soil or wet the sleeves.

ANIMAL HEAD.—B. COHEN, New York, N. Y. This patentee provides an improved head, over which the skin is drawn in fur articles. It is made of soft rubber and is arranged to properly display the head and still render the same flexible, to allow of conveniently placing the head-filling in position in the skin, and to draw the skin into place to give the proper shape to the head, and to provide a fastening jaw for clamping the head to a part of the garment of which the head is a part.

PNEUMATIC HEEL CUSHION.—W. L. GORDON, Deal, N. J. This attachment, which is to be worn in the interior of the shoe, at the heel, is constructed with a novel arrangement for affording a pneumatic cushion; and is provided with a resilient frame tending to support the cushion above the heel so that the action of walking serves to force out the air and afford ventilation to the interior of the shoe.

SKIRT MARKER.—A. WATERMAN, New York, N. Y. The purpose of the invention is to provide a skirt marker which can be attached to any garment form having a standard and with which it is possible to mark a skirt placed on the form as to length and evenness of length, with the same ease and accuracy as if the skirt were hung upon a person.

SHOE.—T. SKERRETT, Spokane, Wash. For the use of pole-climbers, shinglers, miners and others, Mr. Skerrett has provided a shoe which has a triple strength for the instep portion from the rear to the toe, and a double quarter and a half double vamp, and a double toe section. The shoe is thus strengthened at the parts which are most liable to wear in climbing.

COAT LAPEL AND COLLAR REGULATOR.—W. H. CLING, Charleston, S. C. The invention provides a device for holding the front breadths of coats and vests distended or stretched in such a manner as to prevent wrinkling or sagging. For this purpose a thin strip of steel is used which may be detachably applied, and whereby the lapels are prevented from rolling back at the lower end.

Of Interest to Farmers.

RIDING CULTIVATOR.—J. A. BURT, Gunnison, Miss. This patentee contemplates improving cultivators in several particulars, including the means for elevating the shovels to clear obstructions; the adjustment of the shovels for acting at the desired depth, and for varying the distance between the shovels. Provision is made also for the more easy manipulation of the cultivator in turning, and for more equally distributing the pull.

PLOW.—T. B. HANSFORD, Stephens, Ga. This improvement relates to the means for adjusting the plow blades to run deep or shallow without the plowman leaving his position at the handles. The plow beam drops at the rear end, and a brace extends from the higher portion of the beam to the handles. The raising device includes a standard fulcrumed to the beam and provided with an adjusting lever extending in convenient reach of the plowman.

CORN HARVESTER AND HUSKER.—T. A. and J. G. OVERBY, Mellette, South Dakota. One of the main objects of the machine designed by these patentees is to so construct the same that the corn will be reached and brought into the mechanism of the machine, and the other operations performed, without the necessity of exercising great care on the part of the operator. The snapping devices have improved means for mounting the same in the frame in a manner to enable them to yield to a desired extent when working, and similarly the husking rolls are supported in separate parts of the frame, providing a space into which any uprooted stalks may pass, in a way to prevent clogging. In various other respects the applicants design to make the mechanism more practical and durable.

INCUBATOR.—C. S. NEWSOM, Athens, Ohio. This patentee has devised an incubator rather out of the conventional form. An important feature is a rotatable egg-holding tray comprising a series of wire cylinders, combined water-holders and heaters being arranged on opposite sides, and these with various other details being designed to have increased practical importance in hatching, protecting, and caring for the chicks.

GRAIN-FEED.—C. G. HAEGERT, Hawley, Oklahoma. The mechanism forming the subject of this patent is designed to take grain either headed or otherwise, from a stack and feed it into the threshing machine. The construction is light and strong; is portable, and is designed to be drawn between two stacks, to operate simultaneously on both. Means are provided for independently adjusting the rakes employed at the sides of the machine, to accommodate them to the height of the stacks. Provision is made for automatically imparting the necessary movements to the rakes to effect the alternate gathering and discharge.

LOADING APPARATUS.—ALCEE LANDRY, Mark, La. This patentee has produced an apparatus particularly adapted for loading sugar cane from the field onto wagons, so that the cane may be handled very expeditiously and with little manual exertion. There is a mast with a swinging boom on the vehicle, and a grapple operated by a special arrangement of drums with their ropes and pulleys for effecting the different operations quickly and with precision. At the side of the vehicle opposite the grapple, a counterbalancing device is mounted, consisting of a pole with a weight at the top which may be raised and lowered to counterbalance the load and prevent the tilting of the vehicle.

INCUBATOR.—G. H. LEE, Omaha, Neb. The latest invention of this patentee is intended as a further improvement on the incubators already patented by him, the particular improvements in the present case relating mainly to the egg-trays and their supports, and the heating features of the structure, the egg-tray devices being designed to facilitate the breaking of the shell by the weight of the chick, and for facilitating the separation of the chicks from the unhatched eggs, the floor being so arranged that the chicks fall into a space below the tray constituting a nursery with a reduced heat.

HARROW.—G. METCALFE, Wilczinski, Miss. The purpose of the invention is to provide a harrow primarily intended for the preparation of soil in cotton culture, in such flat and damp sections of the country as the Yazoo and Mississippi delta, and which will combine with a harrow the qualities of a cultivator whereby to remove from bedded lands all grass, weeds, and clods, and leave a smooth surface for planting. This is a result which cannot be accomplished with the ordinary harrow or cultivator.

INDICATOR.—C. VERSTEEG, Ashton, S. Dak. The indicator comprises an open electric circuit including a signal to be operated by the contact of the terminals of the circuit, the latter being arranged within the bin in a position to be moved into contact by the grain when it reaches a predetermined depth. Means are also provided for preventing the grain from entering between the contact points and preventing their engagement.

Of General Interest.

DEVICE FOR USE IN TRANSFERRING ICE CREAM CANS.—JACOB RENNER, Rockwell City, Iowa. In order to provide a practical and convenient means for removing the ice cream cans from their freezing tubs without disturbing the ice, and transferring the cans as desired in making and handling ice-cream on a large scale, the patentee arranges a cylindrical lifter comprising two pivotally connected handled sections adapted to be passed downward on the outside of the can, and to engage the can so as to lift the latter.

COOKING STOVE.—E. C. COLE, Chicago, Ill. The oven of the stove illustrated in this patent is surrounded by flues or air spaces at sides, top and bottom, and there is an arrangement of deflector plates, which are designed to be given certain bends by the manufacturer of the stove, such as will produce the necessary circulation through the flues, the bends of the plates being varied according to the fuel usually employed in the district in which the stove is intended to be used.

FLEXIBLE TUBING.—G. M. ANDERSON, Hyde Park, Mass. This invention relates to flexible metal tubing and couplings for the same. The tube is made up of longer and shorter sections, the opposing ends of the sections being respectively concaved and convexed so as to rock in any direction, and a spiral spring is arranged either on the interior or exterior of the tubing, coupling the sections together, the coils of wire interlocking with certain of the sections to give the necessary stability.

SPOON HOLDER.—LOUIS J. R. RIVET, New Orleans, La. A unique, practical spoon holder forms the subject of a patent granted to the mentioned inventor, and comprises a piece of metal bent to form a clamp into which the spoon handle may be slipped, and a spur on the under side of the holder which may be inserted into the cork of a medicine bottle, so that the spoon is held horizontally across the top of the bottle.

GLASS WASHER AND SCOURER.—A. W. BEERBOWER, Bryan, Ohio. This invention is mainly intended for use in hotels and restaurants. It is provided with a series of horizontal rotary brushes mounted to be operated by a handle and arranged to act on both the interior and exterior of the glasses. A compartment above the brushes contains a supply of scouring powder, with a cylindrical feeder for delivering the proper amount as required.

POCKET-LIGHTER.—W. C. and C. F. MACDONALD, Rock Island, Ill. It is the object of this invention to provide an improved pocket lighter having a magazine containing fulminating pellets adapted to be successively and safely ejected from a magazine into a socket at the outside of the casing and to be ignited therein for lighting purposes.

APPARATUS FOR PURIFYING NATURAL WATER.—F. JULIAN, St. Paul, Minn. The apparatus provides for purifying, by means of suitable chemicals, water that contains compounds of calcium, magnesium, aluminium, iron, and other impurities. In the case of water containing free acid, or alkali, a neutralizing chemical is used. Mechanically-suspended matter and certain dissolved objects are to some extent carried down with the precipitated impurities.

UMBRELLA-RIB AND STRETCHER CONNECTION THEREFOR.—P. V. BRADY, New York, N. Y. The invention is particularly adapted for paragon umbrella ribs, and its purpose is to provide a lap which can be stamped from a single piece of metal, and clamped to the rib. The lap is partly concealed by the rib and is provided with a knuckle within the groove of the rib to which the stretcher is pivotally attached.

SAFETY DEVICE FOR ELEVATORS.—W. C. TENCH, Lynn, Pa. The invention has reference more especially to safety devices for elevators and provides means for preventing over-hoisting of the elevator cage or elevator within the elevator shaft either from overwinding of the hoisting cable for the cage, or from other causes.

ARTIFICIAL DENTURE.—P. B. LESEMANN, Nashville, and S. J. LESEMANN, Altamont, Ill. The object of the invention is to provide novel means for securing an artificial tooth to a mouth-plate. It enables the ready substitution of a new for a broken tooth on a vulcanized plate without revulcanizing the plate.

RESCUE BUOY.—JERUSHA C. QUARTERMAN, Titusville, Fla. This buoy is especially adapted for use in marine life saving service, and is so constructed that a maximum of hand-holes are provided, permitting a person grasping the buoy at any point of its area to quickly and instinctively secure a firm grip thereon.

DUMPING AND ELEVATING APPARATUS.—P. J. MAUGER, Minier, Ill. Mr. Mauger's invention is an improvement in apparatus for discharging or dumping grain or other articles from a wagon or cart into a conveyor by which it is delivered into a permanent storage receptacle or into a car or boat for transportation. The present invention covers various additions to the original invention which was recently patented by Mr. Mauger.

ROTARY PUMP.—H. R. COMLY, San Diego, Cal. The pump belongs to that class which comprise a cylinder, a cylindrical piston arranged eccentrically therein, and a slidable abutment or cut-off which reciprocates corresponding to the rotation of the piston, whereby fluid is taken in and ejected from the cylinder at each rotation of the piston.

PRIMING DEVICE.—J. W. GRAEME and R. W. MCNEELY, Navy Department, Washington, D. C. The invention has for its object to provide recording mechanism in connection with an improved primer, whereby a record is made of when the primer has been fired. The invention also comprises means for increasing the efficiency of the primer.

CLAMP.—E. R. ERICKSON, New York, N. Y. The clamp forming the subject of this patent is intended for use by wood-workers and other artisans. The improvements comprise clutches arranged in connection with one of the jaws of the clamp, to function as the jaw is brought into engagement with the work, the clutches acting automatically to prevent backward movement of the jaw.

MATCH BOX.—W. P. LOCKE, Canton, Ohio, has obtained a patent on a novelty in the shape of a match box of the general class in which a single match is delivered at a time. The present inventor utilizes the tray of the ordinary match box, and provides on a base a plate-like member to form a cover for the box tray and engage the same by spring arms, the plate having an opening of such a form as to permit a match to be grasped and allow the removal of one at a time. When not in use, the plate may be folded downward against the base.

Hardware.

RULE.—H. D. HAGERMAN, Houlton, Me. The invention consists of an ordinary two-foot rule having the outer hinged members grooved on their opposite edges with a metal scabbard secured therein to one of the members. The scabbard is adapted to receive a scriber which is held from accidental displacement.

CLAMP.—E. R. ERICKSON, New York, N. Y. This clamp is of simple construction and is so designed that the distance between the clamping faces may be quickly and readily adjusted to receive objects of different thicknesses. The invention is specially useful for the purposes of a joiner or cabinet-maker to hold members which are being glued together.

Heating and Lighting.

PROCESS AND APPARATUS FOR GENERATING A COMBUSTIBLE GAS FROM CARBONACEOUS LIQUIDS. — F. COTTON, Hornsby, N. S. W., Australia. The apparatus is adapted for utilizing the residuum of petroleum and other liquids of like nature to produce a highly combustible gas. It consists in simultaneously introducing oil and steam in a receiving chamber of the apparatus and mixing the fluids after which the resultant mixture is introduced into a forward chamber or retort and burned.

APPARATUS FOR GENERATING ACETYLENE GAS.—A. ROSENBERG, 259 High Holborn, London, England. The invention relates to an apparatus employed in the production of gases by the reaction occurring progressively between a liquid and solid reagent which are permitted to gradually come into contact with one another. The vessel in which the solid reagent is transported or stored is designed to serve as a generator for the gas when it is immersed in the liquid reagent.

OIL-BURNER.—S. M. MORRISON, Bakersfield, Cal. This improved burner is adapted for use in a small stove or in a large furnace in both of which cases the combustion is complete and a smokeless fire produced. A low grade of distillate or crude oil is used for the fuel and means are provided for removing the waste product. Where crude oil is used the asphalt drawn off, if preserved, is of more value than oil in its crude state.

REGULATOR FOR GAS BURNERS.—A. A. PRATT, New York, N. Y. This invention relates mainly to incandescent burners, the object of the improvement being to so construct the burner that it forms a regulator which serves to control the amount of gas passing from the supply pipe into the mixing chamber of the burner, so as to form an inflammable mixture of the proper proportions of gas and air according to the quality and pressure of the gas supply. We note the devices for carrying out the purpose are quite simple in form and arrangement.

PIPE FITTING FOR HOT WATER HEATING SYSTEMS.—JOHN O'NEILL, New York, N. Y. The fitting forming the subject matter of this patent is intended mainly for use in a type of hot water heating system designed by the same inventor, the fitting being intended more particularly for embodiment in a three-pipe heating system. It results in forming the necessary connections by a reduced number of fittings, while insuring a proper circulation of the heating medium through the pipes and radiators.

Household Utilities.

WEATHER-STRIP.—T. J. JOHNSON, Norman, Okla. Ty. The weather-strip is hinged to the door in such a manner that when the door is closed the weather-strip is thrown down by a contact pin on the door jamb. Means are also provided for moving the weather-strip endwise, thereby permitting the use of a slightly longer weather-strip than would otherwise be practicable, and forming a closer fit or joint.

Machines and Mechanical Devices.

PASTEURIZING APPARATUS. — H. E. WEBER, Canton, Ohio. The milk is first brought to a comparatively high temperature and then by one or several successive stages quickly reduced to a considerably lower temperature. In order that the greatest efficiency be obtained the change in temperature is accomplished as nearly instantaneously as possible, and every particle of the liquid is individually subjected to the heating and cooling treatment.

GARMENT-PRESSING MACHINE.—J. B. REPLOGLE, Chicago, Ill. The machine is so designed as to enable the material of a garment to be subjected to a pressure by a pressing iron, the position of which is readily controlled. The construction is such that the machine may be driven by power as well as manual force in applying the pressure.

GEARING.—J. K. KOONS, Montgomery, Pa. A peculiar construction of transmission mechanism has been provided by Mr. Koons whereby a sharper graduation of the ratio between the differential gears is permitted. At the same time the construction provides a certain amount of flexibility in the connection between a countershaft and the driving shaft.

BRICK OR BLOCK MACHINE.—D. F. MCDONALD, Lake Butler, Fla. The patent granted to this inventor discloses a new form of mold for molding bricks or building blocks out of cement composition. The mold is of very simple form and is intended to have special usefulness in isolated places or localities where large and costly machines are not available. In general form the apparatus includes two handled bars or levers arranged on a rectangular frame, the levers carrying each a section forming one side and one end of the mold, so that the mold is completed by the two sections when the levers are brought together.

SLUG COUNTER.—W. N. BOWMAN, Pierre, So. Dak. The subject of this patent relates to linotype machines. The inventor has in view to enable an operator, in setting up matter in which a plurality of slugs are used to form a single line, to determine readily at what point in the line a slug is being cast, and thus avoid a difficulty commonly experienced with operators in keeping in mind the precise order of the slug on which they may be working.

DOUGH-ROLLING MACHINE.—WILLIAM FRANK, Guttenberg, N. J., discloses in a recent patent a dough-rolling machine especially intended for forming the dough into substantially spherical shape, the special merits claimed for the machine being its simplicity, the resulting quickness of the operations, and the feasibility of separating the sections of the machine for cleaning. In general, there is a concave wheel co-acting with a grooved casing, so that a circular space is provided into which the dough is fed by a funnel, and from which it is ejected at the opposite side by the rotation of the wheel.

MACHINE FOR REFINING FLOUR.—C. L. GERRARD, Columbus, Neb. The apparatus de-

signed by this inventor relates to the forcing of nitric oxid or other gas mixed with air through wheat flour and other products in bleaching and refining the flour, an important object being to effect a uniformity in the generation of the gas. An examination of the specification and drawing of the patent is necessary to an appreciation of the mechanism and its operation.

WASHERS.—JOHN R. HUGHES, Chama, New Mex., has patented an improvement in the washers employed in connection with cotter-pins of various machines. The washer is slitted and has pressed upward at opposite sides of its opening or eye, integral portions of a shape to constitute offsets and receive the cotter-pin.

GAGE.—GEORGE ARNOLD, Chicago, Ill. A unique gage forms the subject of a patent granted to this inventor, the device being applicable to augers and like boring tools, and so formed that it may be quickly secured in place on the bit at the desired distance from the point of the auger so as to define the depth to which the hole will be bored.

CRUSHING ROLLS.—JOSÉ PELAEZ RODRIGUEZ, Caibarien, Cuba. This patentee primarily intends his improvement to be embodied in the rolls for crushing sugar cane. The improvement is characterized by a special form and disposition of teeth on the surface of one of the rolls, the merits claimed being that a more complete laceration of the cane is effected, so as to enable a thorough extraction of the juice to be obtained.

IMPROVED ROD PACKING.—G. STEWART and G. F. STEWART, New York, N. Y. These inventors have devised a modification of the metallic packing of piston rods. The packing is of the type employing split rings, and the arrangement of retaining and adjusting devices is such as to cause frictional contact between the rod and the packing rings when the piston is on the outward stroke, so as to force the packing rings tightly together and in close contact with an encircling sleeve, the frictional contact releasing on the return stroke.

Prime Movers and Their Accessories.

TRANSMISSION-GEAR. — J. CHALMERS, Bath, Maine. The improvement refers to a means for transmitting rotary motion reversely and at various speeds. It is useful, particularly in connection with internal-combustion engines employed for driving boats and vehicles. Novel features reside in the construction and organization of the devices for connecting the loose gear at will with the transmitting element coacting therewith, in the arrangement of the reverse transmission, on the general organization of the mechanism within its case, and various others of importance.

LUBRICATOR.—J. J. SLAGEL, Fairbury, Ill. —The invention relates to a lubricator of that type used in connection with engines, particularly steam engines, and embodying a pump for forcing the lubricant through a sight-feed device and thence into the steam pipe or other part of the engine, so that the oil passing into the engine with the steam lubricates the valves and cylinder.

COMBINED VALVE-STEM CLAMP AND LUBRICATOR.—J. C. WILLIAMSON and W. D. BARKER, Tallahassee, Fla. The purpose of the invention is to provide a combined valve-stem clamp and lubricator arranged to lubricate the valve-stem outside and immediately adjacent to the stuffing box, and to permit the engineer to quickly and securely lock the valve-stem, and hence the valve, against movement in case of a breakdown of the corresponding engine so as to allow running of the locomotive by the use of the other engine alone.

Railways and Their Accessories.

CAR-COUPLING.—H. V. ROGERS, Tiosa, Ind. The object of this inventor is to provide a novel form of coupling that will not only automatically couple when two cars are brought together, but will uncouple should an accident occur—such, for instance, as the derailing of a car, tipping over of a car, or a car breaking down at the center.

RAILWAY-SWITCH. — C. E. MCDONALD, Butte, Mont. In the present patent the invention has reference to railway switches; and the object of the improvement is the production of a switch which is so constructed that it will enable a car on the main track to pass from the main track in either direction.

AIR-BRAKE ATTACHMENT.—J. B. O'DONNELL, Freeland, Pa. The object in this case is to provide means by which the engineer on a train equipped with the automatic air-brake system may be given full control of the triple exhausts independently of and notwithstanding the usual retaining-valves. This is attained by fitting to the triple exhaust a valve closing by the brake-cylinder pressure and commanding a vent to the atmosphere, which valve is under the control of the engineer through the medium of a fluid pressure device actuated by the train-line pressure.

DEVICE FOR MOVING CARS.—J. D. TUSAR, Forest City, Pa. Mr. Tusar has invented a device which may be attached to heavy cars to move them a short distance. The invention is particularly applicable to mining cars to move them up a steep grade. The device may be operated by one man without any danger to the operator.

RAILWAY-SWITCH. — J. HERRINGTON, Houston, Texas. The invention is an improvement in switches of the type adapted to be operated automatically by the wheels of the cars or engines, thereby dispensing to a considerable extent with the work of a switchman, and at the same time lessening the likelihood of an accident caused by negligence in leaving the switch open.

SANDER.—G. E. CUMMINS and H. S. FERGUSON, Cherokee, Kans. The invention relates particularly to a sander for locomotives. In sanding devices operated by compressed air the sand tends to clog the air passages and interfere with the proper operation of the device. It is the object of the present invention to overcome this disadvantage.

RAIL-JOINT.—T. CRANE, East Branch, and J. M. WHEELER, Fishs Eddy, N. Y. The object of the present invention is to produce a rail-joint of simple construction which may be quickly applied and which will operate to hold the abutting ends of the rails securely without necessitating the employment of bolts and nuts.

Pertaining to Recreation.

PLACE AND POSITION INDICATOR.—F. H. SCHAUFFLER, New York, N. Y. One purpose here is to provide a device whereby to indicate place and position by lot or design for various persons at tables or at other places where games of cards and other games are played, whether independently or as partners, in which latter event partners have their places and positions decided by lot or design, and, further, to provide a device applicable to any occasion where place and position are not to be selected by participants.

Pertaining to Vehicles.

LUBRICATOR.—S. J. WELTER and G. C. WELTER, Roswell, New Mex. The invention pertains to a device for lubricating wagon-axles successfully and doing away with the necessity of taking the wheel from the axle when the oil is applied. On account of the inconvenience of taking wheels from axles it is well known that they are frequently left on so long as to become dry and to burn out the bearings. This device can be filled with oil while a wheel is on the axle.

DUMPING-CART.—J. GUIRY, New York, N. Y. A cart is employed having a body, together with a cover and means for raising the same to enable the cart to be dumped when desired. Means are also used for sustaining the cover of the cart in its raised position and for preventing the cover from being carried or thrown beyond a determinate position forwardly of the structure.

STREET-CLEANER'S TRUCK. — J. REHM and T. VON GERICHTEN, New York, N. Y. The object of the inventors is to produce a truck which will afford means for carrying a receptacle, such as a can, conveniently, which will facilitate the raising and dumping of the refuse from the street into the receptacle, and which will facilitate the removal and replacing of the receptacle upon the truck.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 8412.—Wanted, a light-running pump, which will pump about a half-inch stream of water; force pump preferred.

J. C. Sparks, B.Sc., F.C.S., Chemical Expert. See adv't.

Inquiry No. 8413.—Wanted, machinery for use in the manufacture of carbonic acid gas.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 8414.—Wanted, granulated iron oxide and aluminium, suitable for the Thermit process of welding.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 8415.—Wanted, makers of elastic rope or cord similar to that used on the Whitly exercising machines.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 8416.—Wanted, an automatic machine or electric pencil or needle for writing on glassware and engraving on pearl or glass novelties.

I sell patents. To buy, or having one to sell, write Chas. A. Scott, 719 Mutual Life Building, Buffalo, N. Y.

Inquiry No. 8417.—Wanted, addresses and catalogues of manufacturers of machinery for making rubber horse-shoes.

The celebrated "Hornsby-Akroyd" safety oil engine. Koerting gas engine and producer. Ice machines. Built by De La Vergne Mch. Co., Ft. E. 138th St., N. Y. C.

Inquiry No. 8418.—Wanted, addresses of schools of automobile engineers in cities in the vicinity of Fort Wayne, Ind.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machine work and special size washers. Quadriga Manufacturing Company, 18 South Canal St., Chicago.

Inquiry No. 8419.—Wanted manufacturers of pyroline.

Inquiry No. 8420.—Wanted odorless excavator for handling night soils and sewage.

Inquiry No. 8421.—Wanted, a machine for printing metal signs with paint.

Inquiry No. 8422.—Wanted, cardboard disks, or disk-making machinery.

Inquiry No. 8423.—Wanted, machinery for making starch from potatoes; also for the production of alcohol from potatoes.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

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Scientific American Supplements referred to may be had at the office. Price 10 cents each.

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Minerals sent for examination should be distinctly marked or labeled.

(10177) P. H. K. writes: Is ice formed from sea water salt or fresh? A claims that it is salt. B claims that it is impossible to have salted ice, as in the process of freezing the salt is eliminated. Who is right, A or B? A. When aqueous solutions freeze, the solids in solution tend to separate from the water, and the ice thus formed is pure or nearly so. It would not be easy to form a block of uniformly salted ice. This is sometimes expressed by saying that water freezes itself pure, which is not a very correct manner of stating what takes place. The water freezes molecule by molecule, and the solid in solution is separated from its solvent, the unfrozen portion of the solution becoming finally a saturated solution. B has the better of the argument.

(10178) H. L. S. says: Will you please inform me how to connect up an electric bath-tub? A. If the tub is of metal, connect one of the electrodes to the metal, while the other is held in the hand. If of porcelain, connect one electrode to a metal plate and place in the water.

(10179 M. M. asks: 1. If lightning strikes in a body of water where a man is swimming, will he feel it if it strikes within a hundred yards of him? A. We do not know any reason why a person should be affected by lightning striking the water in which he is swimming. The earth is at zero potential and is of infinite capacity, from which it follows that no amount of electricity can raise the electrification of the earth so that a man could be shocked by it when he is immersed in it. The case is the same as that of a man buried in the ground or in a cellar under the ground. No lightning stroke can harm him in either of these positions. Of course a man's head projecting above the water might be struck, but this is not the condition which you suppose. 2. Which will break first, a rope 5 feet long or a rope 100 feet long, if it has the same strength all over the rope and the same strength pulling it? A. If two ropes, one 5 feet long and the other 100 feet long, are pulled equally, the ropes being supported at the ends only, the longer rope will break first, since its weight is greater than that of the shorter rope, and is added to the pull upon it. If the ropes were lying on the ground or other support, we do not think the difference in length would make any difference in breaking strength, although we are aware that many hold the opposite opinion.

(10180) J. W. H. asks: Is there any difference in the strength of a magnet with a ¼-inch core and one with a ⅛-inch core if both are wound with the same amount of wire? Would it make any difference to the strength of a magnet having a ¼-inch core to have the core thinned down to ⅛ inch at the bending point? The reason for doing this is to make it easier to bend after the magnet is bound. A. The ease with which lines of magnetic force can pass through the core of an electromagnet is proportional to the sectional area of the core. For this reason a core ¼ inch in diameter will transmit four times as many lines as a core ⅛ inch in diameter, if all other conditions were the same. We should not advise the winding of an electromagnet and bending the core after the winding. It is much better to wind the coils on spools which will slide over the iron core and put them in place after the core has been bent into its final shape.

(10181) N. R. R. asks: Will you please let me know whether natural ice is colder than manufactured ice or not? The latter is made at a temperature of 20 degrees above zero, and natural ice undergoes a temperature sometimes many degrees colder. Does it retain this greater cold? A. All ice, natural or artificial, in any place below the freezing point will have the temperature of that place; in any place above the freezing point it will have the temperature of the freezing point. Ice does not retain its temperature below the freezing point. It cannot be heated above the freezing point, under ordinary circumstances. Like any other solid, ice is cooled in the winter to the temperature of the air, be it zero or below, and becomes warmer as the temperature rises till its melting point is reached. Then it cannot be made hotter. It changes its condition to the liquid form.

NEW BOOKS, ETC.

SYMMETRICAL MASONRY ARCHES. By Malverd A. Howe, M.Am.Soc.C.E. New York: John Wiley & Sons, 1906. 8vo.; pp. 170. Price, $2.50.

The author presents in simple form, with due consideration for the theoretical aspects of the question, the methods to be employed in the designing of masonry arches according to the *elastic theory*. As masonry arches are constructed of materials and under conditions which are more or less uncertain in character, it has been found that rigid and comprehensive formulas are hardly necessary, and consequently those presented in this book are approximate, but nevertheless of sufficient accuracy for the purpose. Many examples are given with each step of the solution in detail. Thus they are easily comprehended by the student or the engineer who has not the requisite time to review the theory of arches thoroughly.

DESIGNS FOR SMALL DYNAMOS AND MOTORS. By Cecil P. Poole. New York: McGraw Publishing Company, 1906. 8vo.; pp. 186. Price, $2.

The text of this book comprises a number of articles which have previously appeared in the American Electrician, and part of which is included in Electrical Designs, by the same author. While Mr. Poole has avoided theoretical calculations and reasonings, as far as possible, a certain amount of practical knowledge of the subject will be necessary for the reader to utilize the text to the best advantage; but the descriptions will be intelligible to any person who is somewhat familiar with the construction of such machines as the book covers. Each chapter comprises one design and gives the actual details of design in the form of working directions, avoiding the underlying principles and the reasons for the various steps. This is a rather unfortunate feature of the book, and greatly decreases its educational value. The working drawings are good, and will be clear to anyone familiar with ordinary shop practice.

COMPLETE EXAMINATION QUESTIONS AND ANSWERS FOR MARINE AND STATIONARY ENGINEERS. By Calvin F. Swingle, M.E. Chicago: Frederick J. Drake & Co., 1906. 32mo.; pp. 367. Price, $1.50.

The past few decades have witnessed such tremendous development in the science of steam engineering that our present day sees the creation of power plants of marvelous complexity and detail as compared with the steam machinery of less than half a century ago. In view of the remarkable improvements in steam machinery which have been made, it is of the utmost importance for the engineer to keep in constant touch with its advances. The author of the present book has endeavored to place before his readers information in a catechetical form to cover the various details appertaining to the operation of modern steam plants both stationary and marine. The questions are practical, and can be understood without extensive scientific knowledge. The answers have been so designed as thoroughly to cover the questions, and in many cases are supplemented with excellent illustrations.

HANDBOOK OF MATHEMATICS. By J. Claudel. Translated and Edited by Otis Allen Kenyon. New York: McGraw Publishing Company. 8vo.; pp. 708. Price, $3.50.

The reader will find this a useful compendium of the so-called "practical" subdivisions of mathematics, including the entire range of the subject between simple arithmetic and differential and integral calculus. The work is well written and well translated, and is an able and successful effort to provide a compendium of the various branches of the subject, each of which is usually treated in a special monograph rather than as a chapter of a larger volume. While individual users may find many omissions, it will be understood that the demands placed on such a work must necessarily be so varied that many of these omissions are hardly avoidable. It is unfortunate that no index is provided, as well as a list of tables.

FIVE-FIGURE LOGARITHMS OF NUMBERS AND ANGULAR FUNCTIONS FOR THE USE OF THE ENGINEER, CONSTRUCTOR, AND STUDENT. By Henry Harrison Suplee. Philadelphia: J. B. Lippincott Company, 1906. 32mo.; pp. 91. Price, $2.

MOTORI A GAZ. By Vittorio Galzavara. Milan: Ulrico Hoepli, 1906. 32mo.; pp. 423 + 64.

STAMPAGGIO A CALDO E BOLLONERIA. By Ing. Gino Scanferla. Milan: Ulrico Hoepli, 1906. 32mo.; pp. 165 + 64.

CARBONI FOSSILI INGLESI. COKE-AGGLOMERATI. By Dr. Guglielmo Gherardi. Milan: Ulrico Hoepli, 1906. 32mo.; pp. 586 + 64.

PLANTS AND THEIR WAYS IN SOUTH AFRICA. By Bertha Stoneman. New York: Longmans, Green & Co., 1906. 16mo.; pp. 283. Price, $1.10.

SUR L'UNITÉ DES FORCES ET DE LA MATIÈRE. By Doct. Prof. Pierre Palladino. Turin: J. U. Cassone, 1906. 16mo.; pp. 143.

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The Great Difference In Life Insurance Companies

is not revealed by their names nor their claims. The day before the San Francisco disaster, all Fire Insurance Companies seemed alike to the thoughtless; there was a great difference nevertheless, and when the test came, some quibbled, some defaulted, while others drew on the reserve funds which they had ready for such a contingency, paid the large amounts due, and went right on.

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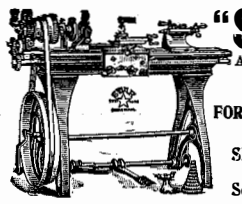

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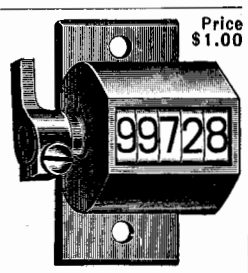

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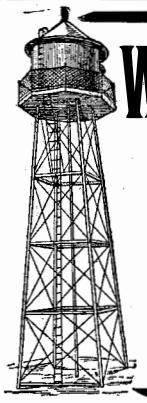
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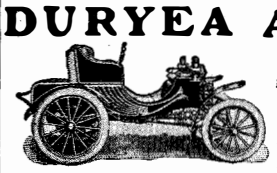
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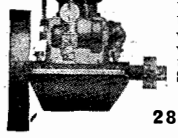
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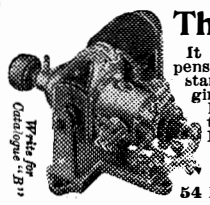

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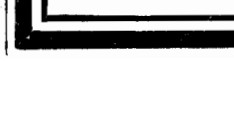

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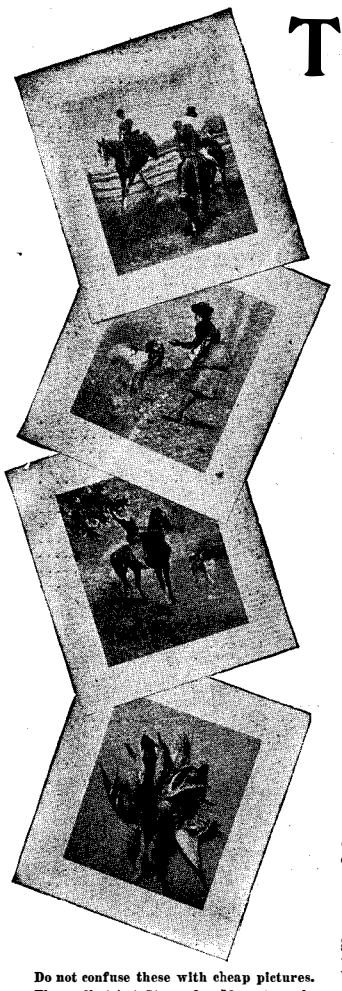

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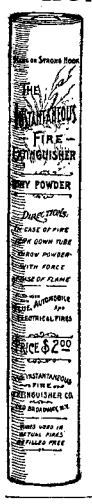

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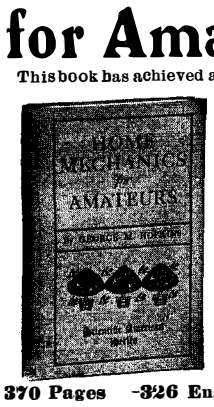

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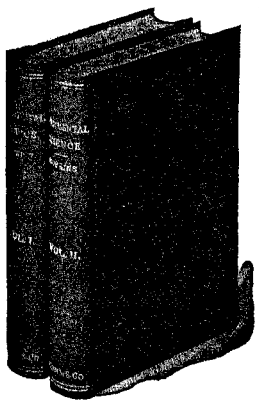

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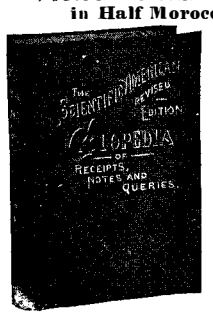

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Wells, fishing tool for, J. H. Morrow	832,920
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Wigs in place, securing, W. Sleicher	833,092
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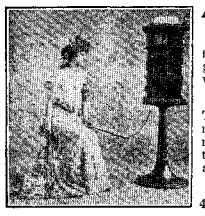

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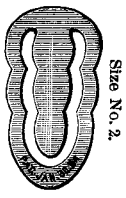

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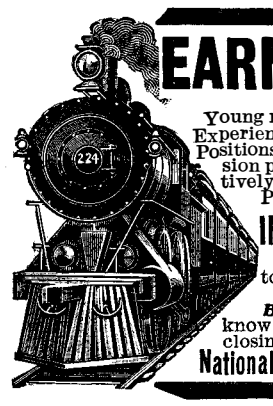

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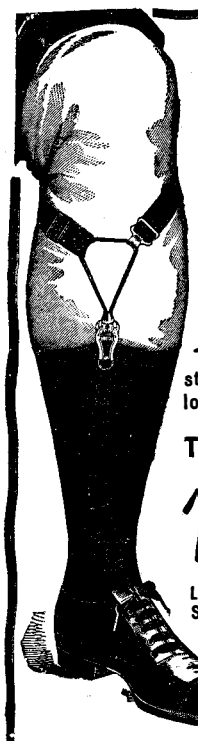

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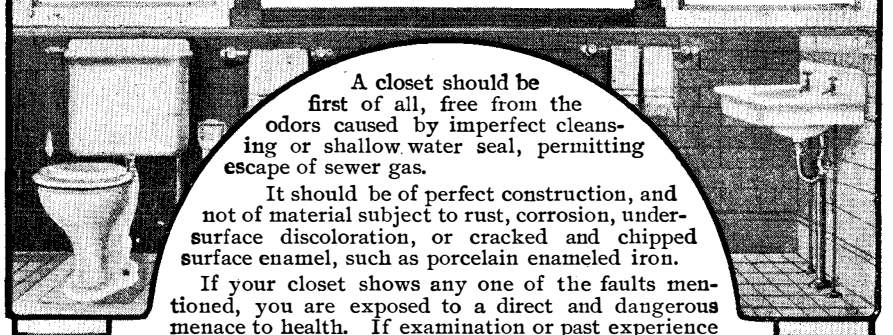

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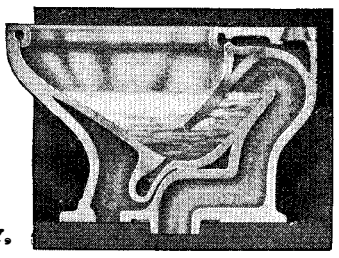

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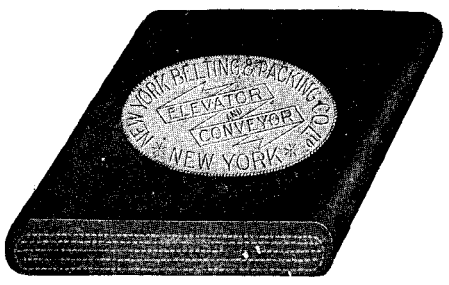

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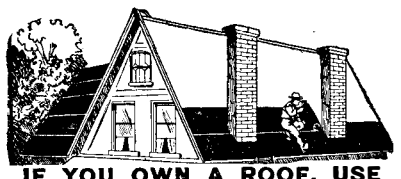

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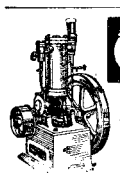

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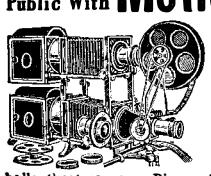

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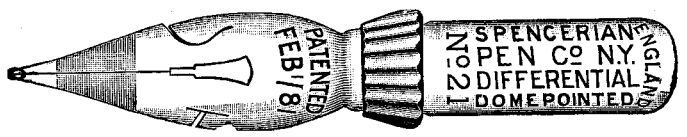

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Fall shaped points for free hand writing, will avoid scratching and spurting. Will write smoother, last longer than other steel pens. **Ask for Dome Pointed No. 21.**
Twelve Samples sent on receipt of 10 cents.

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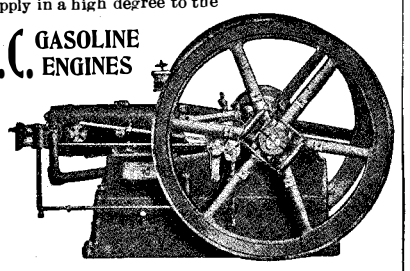
The Good Power

Should be simple, easy to run and keep in order, of full rated horse power, economical in fuel and the use of oil, free from the necessity of repairs and so constructed as to endure indefinitely. These power essentials apply in a high degree to the

I.H.C. GASOLINE ENGINES



In addition they are adapted to every power use and requirement. They give perfect satisfaction under proper instalment.
They are made in several styles—Horizontal (like cut here shown), Stationary or Portable, 4, 6, 8, 10, 12, 15 and 20 horse power. Vertical, 2, 3 and 5 horse power.
Buying an I. H. C. Gasoline Engine puts you right and keeps you right on the power question. A complete investigation of these facts will serve your interest well. Better begin at once by writing for our engine catalog.
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The original and only genuine red sheet packing.

The only effective and most economical flange packing in existence.

Can't blow Rainbow out.

For steam, air, hot or cold water, acid and ammonia joints.

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MORE POWER

You can get more power for your motor car or boat by installing an
Apple Battery Charger.
It automatically generates a current that keeps the batteries always full and in a healthy condition. Hotsparks to meet every charge insures more power and speed. Write to-day for full information.
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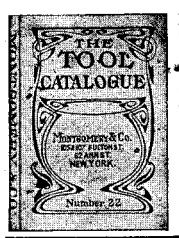

In fact you can have it **free!** This cut represents our new **Tool Catalogue No. 22.** It is cloth-bound and contains 950 pages **all about Tools.** Full descriptions and thousands of illustrations. Sent post-paid on receipt of $1.00 which is refunded on your first purchase from us of $10.00 or over

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THE Nulite Vapor GAS Lamps

For Home, Store and Street
We also manufacture Table Lamps, Wall Lamps, Chandeliers, Street Lamps, Etc. 100 Candle Power seven hours ONE CENT. No Wicks. No Smoke. No Odor. Absolutely safe. THEY SELL AT SIGHT. Exclusive territory to good agents. ☞ Write for catalogue and prices.
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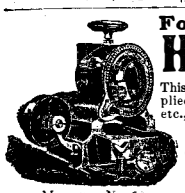

This machine is the regular hand machine supplied with a power base, pinion, countershaft, etc., and can be worked as an ordinary power machine or taken from its base for use as a hand machine. Length of pipe handled easily in small room. Illustrated catalogue—price list free on application.
MACHINE No. 18. Range 2½-4 in. R. H.
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Heaviest oily grain leather—tan colored. Watertight construction. Comfortable and nearly indestructible. Send for pamphlet
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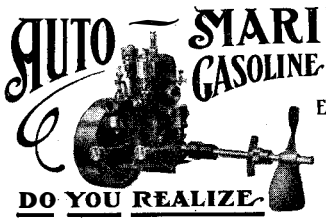
AUTO-MARINE GASOLINE ENGINE



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1½ H.P. $33.75
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When you buy our 5 HORSE POWER MOTOR you own the best gasoline engine ever made for its size and weight.
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4 h.p. bare engine will develop 5
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Get prices on 1 1-2 to 24 h. p. Engines
Reversible engine. Jump spark. Perfect lubrication. Crank shaft **drop forged steel.** Connecting rod, **bronze.** Pistons **ground** to fit. All bearings either bronze or best babbitt. **Best material** and workmanship throughout.
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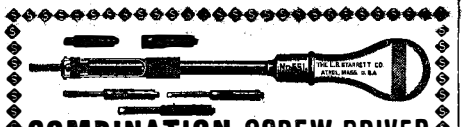

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Complete, with three screw driver tips and three brad awls, $1.50
Send for particulars. Catalogue No. 17 B of Fine Tools free.
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Brighter than electricity or acetylene --cheaper than kerosene--makes and burns its own gas.
No GREASE, DIRT, SMOKE or ODOR.
A safe, powerful, white, steady light --durable and handsome. Over 100 styles--every lamp warranted.
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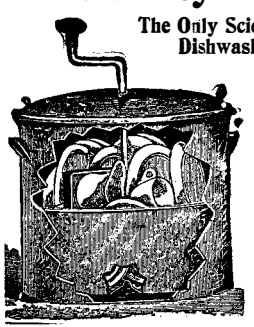
The Only Scientifically Constructed Dishwasher on the Market



No More Drudgery Dishwashing Made Easy
Washes all kinds of dishes, glass and silverware. Can be used on gas, oil, wood or coal stove. Family size will wash 20 to 30 assorted pieces at one time.
There is more popular demand for a cheap, practical and durable Dishwasher than any article that can be mentioned. Every lady wants one. Agents wanted
Our agents, both men and women, are making Big Money. Secure the agency for this wonderful seller in your territory. Agents wanted in all foreign countries. Send at once for testimonials, full particulars and prices. Dept. B.
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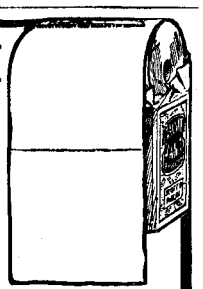

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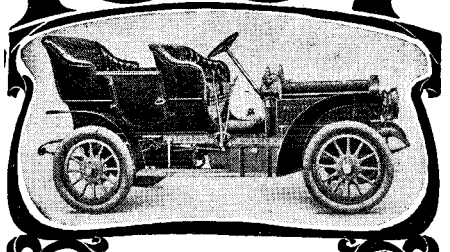
1907



All motordom is agog over the advent of Model H, the brand new four-cylinder Cadillac for 1907, now ready for instant delivery.

In every particular this car is not only up to the minute, but is really *two years* ahead of any other machine on the market. Its many improvements, its mechanical completeness, its superior finish and design, make it imperative for you not to take another step in the purchase of a car until you have learned all about this wonderful

CADILLAC

—an automobile whose smooth and well-balanced action is almost marvelous when compared with that in what has heretofore been accepted as the highest type of motor car. The new and exclusive double acting steering gear greatly increases safety of riding; surprising ease of control is gained through the perfect planetary transmission; a new marine type governor regulates the speed of the engine under all conditions, minimizing vibration and fuel consumption; the independent steel suspension for engine saves wear and strain.

These and a dozen other reasons why you ought to choose the Cadillac will be explained by your nearest dealer. His address, also finely illustrated booklet N, will be sent on request.

Model H will accommodate five persons; **30 horse power;** capable of 50 miles an hour. Price, $2,500.

Other Cadillac models are: MODEL K, RUNABOUT, $750; MODEL M, LIGHT TOURING CAR, $950. All prices f. o. b. Detroit, and do not include lamps.

CADILLAC MOTOR CAR COMPANY, Detroit, Michigan.
Member Asso. Licensed Auto. Mfrs.

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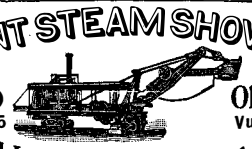
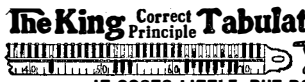


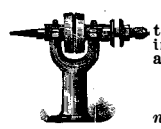
Toledo 125 Ohio, U.S.A. Vulcan Place
The Vulcan Iron Works Co.

The King Correct Principle Tabulator Will add 200% to the value of your typewriter. *Fits all standard machines.*



IT COSTS LITTLE—BUT DOES MUCH.
This simple attachment will save its cost many times each week in time, labor, annoyance, stationery, etc., in making bills, statements or any kind of tabulating. With it any stenographer can do tabulating quickly and correctly. It is easy to put on—easy to operate—will not wear out—will not injure machine. I want to send you one absolutely free for trial. No obligation to purchase. If you like it send me $2.50; if not return at my expense.
W. V. KING, 117 N. 8th Street, St. Louis, Mo.
Be sure to give make and model of your machine.

Head and Shoulders Above 'Em All



This polishing head is fitted with a three-jawed chuck, holding up to ¼ inch. This added idea is a feature all users will appreciate.

List Price, $4.00

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depends upon a keen razor as a keen razor depends upon an effective strop.
The Radium
is made of specially tanned leather and will unfailingly produce a perfect edge
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